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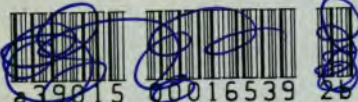
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U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY.
[Grass and Forage Plant Investigations.]

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ON

AMERICAN GRASSES

A REVISION OF THE NORTH AMERICAN SPECIES OF *BROMUS*
OCCURRING NORTH OF MEXICO.

BY

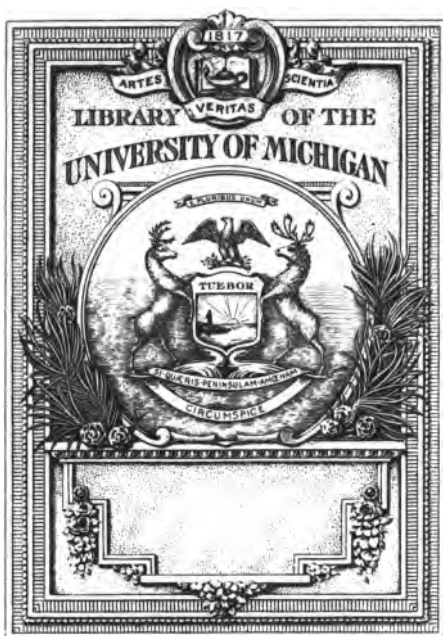
CORNELIUS L. SHEAR,
Assistant Agrostologist.

PREPARED UNDER THE DIRECTION OF F. LAMSON-Scribner, AGROSTOLOGIST.

ISSUED JULY 3, 1900.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1900.



U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

1885

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ON

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., April 9, 1900.

SIR: I have the honor to transmit herewith the manuscript of a paper entitled A Revision of the North American Species of *Bromus* Occurring North of Mexico, prepared under my direction by Mr. Cornelius L. Shear, assistant agrostologist, and recommend the same for publication as Bulletin No. 23 of this division, under the general title of "Studies on American Grasses."

The abundance of good material collected during the past few years in the Rocky Mountains and the Northwest has shown the necessity of a revision of the genus *Bromus*. Until very recently good specimens from these regions have been few, and their identification has rested in many cases on tradition and misconceptions of the species. As an illustration of this, the case of *B. breviaristatus* may be cited. The identification of this species was based by Thurber and Gray on specimens distributed by Hooker under that name. These specimens when compared with the original illustration of the species and the actual type prove to be the old and well-known *B. unioloides*. The examination of portions of the types of Hooker, Link, and Nuttall has made it possible to treat more satisfactorily the various forms from the same region that have passed for *B. ciliatus* and its varieties. Thus *B. vulgaris*, which is one of the best-defined species of the Northwest, has heretofore passed as *B. ciliatus* or *B. purgans*, or a variety of one or the other. The group presenting the most difficulties in the way of satisfactory segregation is that to which *B. carinatus* and *B. marginatus* belong. Here the forms and variations are so many and perplexing that the present disposition of them is necessarily more or less tentative. In the thorough study of the group Fournier's Mexican forms must be considered, and these are so confused and poorly segregated that only a comparison of his types can make a satisfactory disposition of them possible.

The present paper contains descriptions of 36 species and 28 varieties, 45 of which are natives and 19 introduced. The enumeration includes a new subgenus, 3 new species, and 15 new varieties.

Respectfully,

F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

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A REVISION OF THE NORTH AMERICAN SPECIES OF BROMUS OCCURRING NORTH OF MEXICO.

INTRODUCTION.

It does not appear that any attempt has heretofore been made to revise the species of *Bromus* of any very extensive region. In the present paper the species of North America north of Mexico are treated. Those of Mexico are so poorly known that no satisfactory disposition can be made of them until more extensive collections have been examined and the types of Fournier's species and varieties studied. A careful study of the types of the species of Humboldt, Bonpland and Kunth and Presl from the region of the Andes is also necessary in order to correctly understand our southwestern and Mexican species of the subgenus *Ceratochloa*.

The number of known species of *Bromus*, according to Bentham in his "Notes on Gramineæ" in 1881, was about 40. This is the most recent estimate, but according to Index Kewensis and the study of recent literature a total of 150 species would be a conservative estimate of the number at present known. The number of species and varieties described in this paper is 64. Of these 45 are indigenous, and the remaining 19 adventive or introduced. Three are regarded as new species, and fifteen as new varieties. A few species credited to North America still remain doubtful or unknown to us. These have been added at the end of the paper with their original descriptions.

We desire here to acknowledge our great indebtedness and express our thanks to the following botanists who have rendered valuable assistance in the preparation of this paper, either by the loan or contribution of material or by the copying of original descriptions or plates: Drs. B. L. Robinson, Wm. Trelease, N. L. Britton, J. K. Small, P. A. Rydberg, and I. Urban, also Sir W. T. Thiselton-Dyer, Miss Alice Eastwood, and Prof. C. V. Piper.

CLASSIFICATION.

The first step necessary in revising a genus is to decide what shall be considered its type. Then follows the question of its limitations. In this case, as in so many others, Linnæus, who is cited as the author

of the name, was not the first to apply it to a genus. In Gen. Pl. ed. 4, 26. 1752, he cites Monti (Cat. Stirp. Agri. Bonon. Prod. 32. 1719) as the author of the genus. For figures of species which he evidently regarded as typical he cites Scheuchzer's Agrost. Helv. Prod. *pl.* 5. *figs.* 2, 10, 11, 12. 1708. Referring to Scheuchzer's figures, No. 2 appears to be a species of *Deschampsia*, which Linnæus one year later, Sp. Pl. 1: 65. 1753, refers to *Aira cæspitosa*, but does not mention it under *Bromus*, so it is rather evident that the reference to it under that genus was an error. The next figure cited, 10, is undoubtedly a *Bromus*, and is referred by Linnæus to *B. arvensis* l. c. by citation of description but not of figure. By some error on the part of Scheuchzer, his figure 10 is referred to on different pages as representing two different things. Figure 11 Linnæus refers in the same place to *B. squarrosus* and figure 12 in the first edition of "Species Plantarum" is referred to *B. tectorum*, but in the second edition it is referred to *B. mollis* (*hordeaceus*), which it evidently is. Thus it is sufficiently clear what section at least of the genus as here treated, Linnæus had in mind as the basis of his genus. But according to the present rules of American nomenclature, 1753 is taken as the starting point for genera as well as species. Following this, some arbitrary means must be resorted to in deciding what shall be recognized as the types of Linnæus's genera, since there are no generic descriptions in the "Species Plantarum." The most simple and logical plan we believe would be to adopt the first species mentioned as the type, which, applied to the case in hand, would make the type of our genus *B. secalinus*, thus bringing about in this case practically the same results as by the first method, as the species first referred to by Linnæus, *B. arvensis*, *B. squarrosus*, and *B. mollis* are all intimately related to *B. secalinus*.

This genus in the sense in which it is here treated has been the subject of many divisions and subdivisions; at least ten different genera based upon various species have been proposed. The present tendency among many botanists is toward the narrower limitation of genera, but it has seemed best in this paper to maintain the genus in its broadest sense. Of the various genera proposed *Ceratochloa* is perhaps, on the whole, the best defined, while the subgenus *Neobromus* is rather anomalous, and may be eventually found worthy of generic rank. This subgenus, which includes so far as at present known only *Bromus trinii* and its several varieties, shows very close relationship with *Avena* and *Trisetum*, to each of which genera forms of it have been referred. In its various forms it appears to have reached its greatest development in the Andes of South America and is restricted in its distribution to the western portion of the western continent.

The following list shows in order of their publication the various genera proposed for species here included in the genus *Bromus*:

Lasiopoa Ehrh. Beitr. 4 : 147. 1789.

Ceratochloa Beauv. Agrost. 75. t. 15. f. 7. 1812.

Schedonorus Beauv. Agrost. 99. 1812. This, apparently by mistake, stands *Schedonorus* in the index, 177, of the work cited. Beauvois included under *Schedonorus* mostly species of *Festuca*. He cites no type for the genus, so we have accepted the first species mentioned, *Festuca elatior* L., as the type. Only one or two species of true *Bromus* were included by him, one of which was *B. inermis*.

Zerna Panz. Denkschr. Acad. Münch. 296. 1813.

Michelaria Dum. Obs. Gram. Belg. 77. t. 16. 1823.

Libertia Lej. Nov. Act. Nat. Cur. 12 : 755. t. 65. 1825.

Serrafalcus Parl. Pl. Nov. 75. 1842.

Anisantha C. Koch, Linnæa 21 : 394. 1848.

Triniusia Steud. Syn. Pl. Gram. 328. 1854.

Bromopsis Fourr. Ann. Soc. Linn. Lyon n. ser. 17 : 187. 1869.

Zerna was originally made to include the species of the subgenus *Stenobromus* as well as those related to *B. asper*.

Michelaria and *Libertia* are synonyms, both being founded on *B. arduennensis* Dum., a Belgian species resembling *B. squarrosus* somewhat but having the angle on the margin of the flowering glume extended in the form of a tooth.

Serrafalcus was applied to the group containing *B. secalinus* and closely allied species, which Linnaeus regarded as typical of his genus *Bromus*.

Anisantha was founded on *B. pontica* Koch, which is considered to be *B. tectorum* L.

Bromopsis was applied to *B. asper* and *B. erectus*, and is synonymous with *Zerna*, as here emended.

Triniusia was founded on *B. danthoniæ* Trin., and may be a valid genus. It is not represented in our territory.

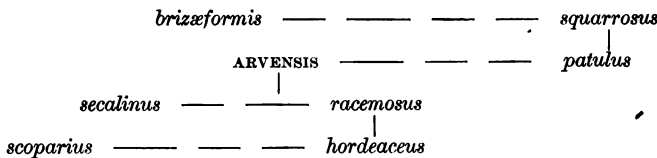
The greatest difficulties in the treatment of the subject are connected with the segregation and delimitation of species and varieties. In order to arrive at a stable basis for the foundation and separation of species, it is quite necessary that one should know exactly what the type of each species is. Various authors differ as to the limitation of species, and it can scarcely be expected that there will be a unanimous opinion as to these limitations, but if the typical form of a species be recognized and taken as the fixed point that must remain undisturbed, however many or few forms may be grouped around it, much confusion would be avoided. As a basis of the present revision we have made a careful study of the original descriptions of the species and also have had an opportunity of examining the types or portions of the types of the most of our endemic forms. This has shown the necessity of a number of changes in the nomenclature of our species, the determination of some of them having heretofore rested upon traditions and interpretations, which investigations of the types prove to be incorrect. Besides the study of original descriptions and types, we have had an opportunity to study most of the forms in the field during the past five seasons, and have also been able to examine the collections of a number of the larger herbaria of this country. The species, as in most of our genera of wide distribution, are very varia-

ble, and their separation becomes to a great extent a matter of personal judgment, and hence arbitrary. Nearly all of the so-called specific characters are variable. The most common variations are in the amount and distribution of the pubescence, the width of the glumes and leaves, and the length of the awns. In most instances the amount and distribution of the pubescence of the flowering glume, taken in connection with other correlated characters of the plant, have been found to furnish a fair basis for segregation, especially where these characters are found to coincide with geographic distribution and environment. It has been found, however, that a character which seems fairly stable in one species may be much more variable in another, so that no character in general can be said to have specific value, but the value of each character must be determined by careful study and observation of the plants throughout a considerable territory. Species founded on single characters are always artificial, rather than natural. There are scarcely any of our species that do not show intermediate forms. In some instances, of course, these are much more numerous than in others. The subgenus *Ceratochloa* presents the most numerous and perplexing forms. These seem to be largely due to the wide distribution and varied climatic and physiographic conditions under which they are found.

The advisability of the adoption of so many varieties may perhaps be questioned by some as tending to make nomenclature too cumbersome. As the chief value of the work, however, seems to us to lie in bringing out as clearly as possible the degrees of relationship and relative importance of the various groups as well as their connection with physical environment and geographical distribution, this course has been followed as best serving the end in view.

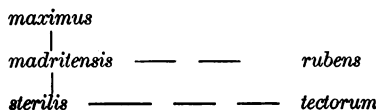
An attempt is here made to illustrate diagrammatically what appears to us the relationships of the subgenera and species.

The first group, *Bromus* proper, is made up entirely of forms which have been introduced from Europe.

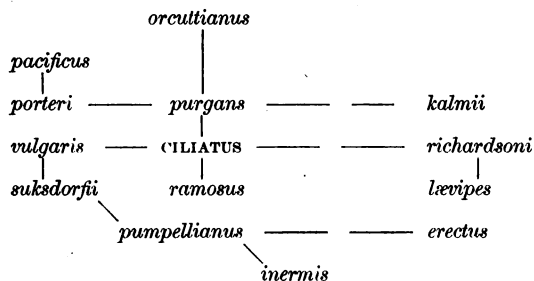


The second group, subgenus *Neobromus*, represented by one species and its varieties, shows no close relation with our other species, but seems to approach nearest *B. scoparius* and *B. tectorum*.

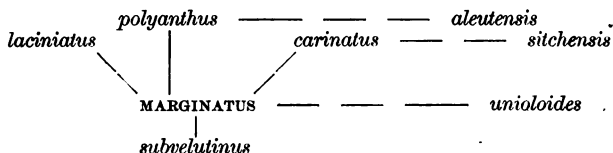
The subgenus *Stenobromus* also consists entirely of introduced species.



The subgenus *Zerna* as here emended contains the largest number of our endemic species. They are widely distributed throughout our region and are quite variable.



The subgenus *Ceratochloa* is apparently peculiar to the western portions of North and South America, ranging from Alaska to Cape Horn.



It is impossible to represent by diagram, except in a very general way, the various relationships of a species. If the species diverged along one or two lines, it would not be so difficult; on the contrary, each shows more or less variation in several directions, so that the typical form might more properly be regarded as a center from which lines diverge in various directions.

The results of this study, which seem to us of most general scientific importance, are those which give us a clew to the derivations and relations of the various species. It will be noticed that comparatively few synonyms are given under the species. By listing all the synonyms given by various authors a very long but unreliable list might have been made; it has seemed to us preferable, however, to restrict the synonymy to those names whose identity we have been able to verify, either by the examination of the types or of authentic material. In rare instances we have been obliged to accept the authority of those who have had excellent opportunity for comparison and study of the species referred to.

DISTRIBUTION.

The genus *Bromus* is most widely distributed in the temperate and mountain regions of the world. The genus seems to have reached with us its greatest development in the Rocky Mountains. In the tropics the species are almost entirely restricted to the higher mountains. Some of the species are more or less distributed in arctic regions also. The highest altitude reached by any species is about 4,000 meters, in the Rocky Mountains of Colorado. The species is *Bromus*

porteri. In the Rocky Mountain region and on the west coast we have abundant representatives of the *Ceratochloa* group, which is found from western Alaska to Cape Horn, but is not represented, so far as we know, on the Eastern Hemisphere, except by introduced forms of *B. unioloides*. Our species in the Northwest show an intimate connection with some of those in eastern Siberia. This is especially marked in the case of *Bromus pumpellianus*, whose Siberian equivalent is *B. inermis*. Unfortunately we have not sufficient material of Siberian species at hand to carry farther the comparison. In the South many forms of the subgenus *Ceratochloa* are connected by way of the mountains through Mexico and Central America with those of the Andes, so that it will be necessary, in order to make a comprehensive and satisfactory disposition of this group, to study carefully representatives from the Andes region, as well as from farther south.

ECONOMIC IMPORTANCE.

A number of species are of economic importance, either on account of their value as forage or because of their weedy propensities. Ranking first as a forage plant comes *Bromus inermis* (smooth or Hungarian brome grass). This species, introduced from Europe, has been extensively tried in the semiarid portions of the West and found to be well adapted to the conditions prevailing there. It is excellent for either hay or pasture.

Bromus unioloides, usually sold under the name of Schrader's brome grass, is another species which has been cultivated considerably in the southern parts of the United States.

Bromus secalinus, cheat or chess, though usually regarded as a weed in grain fields in the East, is cultivated for hay quite extensively in western Oregon and Washington.

Bromus pumpellianus, a native of the northern Rocky Mountain region, has been tried in cultivation and found very promising. It is very closely related to *Bromus inermis* and adapted to similar conditions of soil and climate.

Bromus marginatus latior has also been used for hay to some extent in Oregon and appears worthy of further attention.

Nearly all of the introduced species show decided weedy propensities and are quite troublesome, especially on the west coast. *Bromus hordeaceus* and its variety *glabrescens* have taken possession of vast areas (see *B. hordeaceus*) of deteriorated range land in California, Oregon, and Washington. *Bromus sterilis*, *B. maximus*, and *B. madritensis* are also common weeds in grain fields and waste places in the same States.

BROMUS L. Gen. Pl. 15. 1737.

Spikelets few to many-flowered, slightly or more rarely strongly flattened laterally, in panicles, or rarely racemed; rachilla articulated above the empty glumes and between the florets; florets hermaphrodite or the uppermost imperfect; empty glumes at the base of the spikelet 2, unequal, acute, or the second short-awned, 1 to 7 nerved, shorter than the flowering glumes; flowering glumes keeled or more often rounded on the back, 5 to 9 nerved, usually 2-toothed at the apex, awned from the back just below or from between the teeth, sometimes awnless; awn straight or divergent, sometimes twisted. Palea usually a little shorter than the glume, 2-keeled. Stamens usually 3. Stigmas plumose, sessile, springing from below the hairy cushion-like apex of the ovary. Grain furrowed and grown to the palea. Annual or perennial grasses with flat leaves and rather large, erect or pendulous spikelets.

The genus is very closely related to *Festuca*, from which it differs in general in its larger spikelets, more or less dentate apex to the flowering glume and in the character of the ovary, and the habit of growth which is very rarely caespitose. Some species show close relationship with *Avena*, *Trisetum*, and *Danthonia*, while others are very close to *Melica*.

ANALYTICAL KEY TO THE SPECIES AND VARIETIES.

1. Flowering glume with pubescence about equally distributed over the whole dorsal surface..... 2
1. Flowering glume with pubescence conspicuously unevenly distributed over the dorsal surface, longest and densest on the margins or base or both 25
1. Flowering glume smooth or scabrous..... 35
2. Spikelets 5-9 mm. broad, laterally flattened before flowering 3
2. Spikelets usually less than 5 mm. broad before flowering and terete or subterete. 6
3. Awn not exceeding 7 mm. long, usually shorter..... 4
3. Awn usually more than 7 mm. long..... 24
4. Leaves linear, somewhat involute and pilose-pubescent .. 30 *B. subvelutinus*.
4. Leaves linear-lanceolate, flat 5
5. Panicle narrow, lower branches not exceeding 10 cm. long. 31 *B. marginatus*.
5. Panicle rather broad, some of the lower branches exceeding 10 cm. long 31 *B. marginatus* latior.
6. Panicle rather lax and drooping in flower 7
6. Panicle as a whole not conspicuously secund or drooping in flower..... 17
7. Perennials, native 8
7. Annual, introduced..... 14 *B. tectorum*.
8. Species restricted to the Rocky Mountains and westward..... 9
8. Species east of the Rocky Mountains..... 14
9. Lower empty glume 1-nerved, lanceolate, acute..... 10
9. Lower empty glume 3-nerved, broadly lanceolate, subacute.... 19 *B. porteri*.
10. Lower empty glume 5 mm. or more long..... 11
10. Lower empty glume usually less than 5 mm. long... 19 β *B. porteri havardii*.
11. Sheaths densely pilose-pubescent..... 19 α *B. porteri lanatipes*.
11. Sheaths not densely pilose-pubescent 12
12. Empty glumes more or less pubescent..... 13
12. Empty glumes smooth 19 γ *B. porteri frondosus*.
13. Culm tall, stout; panicle heavy..... 20 *B. pacificus*.
13. Culm rather slender; panicle not heavy 23 *B. vulgaris*.
14. Lower empty glume 1-nerved, acute 15
14. Lower empty glume more or less distinctly 3-nerved 18 *B. kalmii*.

15. Sheaths without a ring of pilose pubescence at the base of the blade..... 16
15. Sheaths with a ring of pilose pubescence at the base of the blade.....
..... 20 α *B. purgans latiglumis*.
16. Sheaths densely soft pilose-pubescent 21 γ *B. purgans incanus*.
16. Sheaths sparsely pilose-pubescent or nearly smooth 21 *B. purgans*.
17. Flowering glumes acute or subacute with not more than 5 distinct nerves ... 18
17. Flowering glumes broad, obtuse or sub-obtuse, 7-nerved..... 22
18. Awn of flowering glume straight at maturity 19
18. Awn more or less twisted and divaricate at maturity..... 21
19. Branches of the panicle rather rigid and spreading in fruit. 22 *B. orcuttianus*.
19. Branches of the panicle not rigid nor broadly spreading..... 20
20. Leaves of the innovations narrow and involute..... 26 *B. erectus*.
20. Leaves not involute and panicle not strictly erect .. 21 β *B. purgans texensis*.
21. Panicle more than 2 dm. long..... 9 α *B. trinii pallidiflorus*.
21. Panicle smaller; mostly less than 2 dm. long..... 9 *B. trinii*.
22. Awn twisted and divaricate at maturity 23
22. Awn not conspicuously twisted or divaricate..... 3 *B. hordeaceus*.
23. Panicle dense; usually less than 12 cm. long.. 3 α *B. hordeaceus intermedius*.
23. Panicle looser; more than 15 cm. long 9 β *B. trinii excelsus*.
24. Leaves of the innovations numerous, narrow 35 δ *B. carinatus linearis*.
24. Leaves of the innovations few; more than 2 mm. broad 35 *B. carinatus*.
25. Panicle rather broad, loose and drooping..... 26
25. Panicle rather narrow and erect or not conspicuously drooping 31
26. Awn more than 6 mm. long 27
26. Awn less than 6 mm. long..... 29
27. An introduced species with broad, loose panicle..... 15 *B. ramosus*.
27. Native species, with rather narrow panicles..... 28
28. Leaves and sheaths glabrous; leaves usually more than 7 mm. broad
..... 23 α *B. vulgaris eximius*.
28. Leaves and sheaths more or less pilose-pubescent; leaves less than 7 mm. broad
..... 23 β *B. vulgaris robustus*.
29. Flowering glume pubescent above the middle on the margin and across the lower
half of the back..... 30
29. Flowering glume ciliate-pubescent on the margin, the pubescence extending very
little above the middle..... 31
30. Ligule 2 mm. or more long; plants with creeping rootstocks ... 24 *B. laevipes*.
30. Ligule less than 2 mm. long; plants without creeping rootstocks
..... 17 *B. richardsoni*.
31. Native of the Rocky Mountains westward and northward.....
..... 17 α *B. richardsoni pallidus*.
31. Native of the Northeastern States and northward..... 16 *B. ciliatus*.
32. Panicle broad, branches widely spreading in flower, introduced.. 27 *B. inermis*.
32. Panicle rather narrow with erect or ascending branches 33
33. Panicle narrow and rather rigidly erect; flowering glume short-pubescent or
puberulent on the margin 25 *B. suksdorfii*.
33. Panicle not rigidly erect..... 34
34. Awn wanting or not exceeding 2 mm.; flowering glume with margin short-
pubescent 28 β *B. pumpellianus melicoides*.
34. Awn usually exceeding 2 mm..... 35
35. Margin of the flowering glume very densely ciliate-pubescent nearly to the apex
..... 28 α *B. pumpellianus tweedyi*.
35. Margin of the flowering glume with shorter pubescence not reaching to the
apex 28 *B. pumpellianus*.
36. Spikelets large, somewhat laterally compressed before flowering 37

36. Spikelets not flattened laterally before flowering.....	49
37. Awn exceeding 7 mm. long.....	38
37. Awn less than 7 mm. long.....	41
38. Flowering glume very broadly lanceolate, subacute, distinctly 7-nerved	33 <i>B. aleutensis</i> .
38. Flowering glume lanceolate, acute, usually 5-nerved.....	39
39. Flowering glume 18-20 mm. long; awn 11-15 mm. long	35 β <i>B. carinatus hookerianus</i> .
39. Flowering glume 14-16 mm. long; awn 7-10 mm. long	40
40. Panicle very broad, longest branches 15 mm. or more long, lax and drooping; leaves broad.....	34 <i>B. sitchensis</i> .
40. Panicle narrower, longest branches less than 15 mm. long; leaves rather narrow..	35 α <i>B. carinatus californicus</i> .
41. Panicle erect or suberect, lower branches rarely more than 10 cm. long.....	42
41. Panicle with upper part more or less drooping; lower branches rather weak, the longest usually more than 10 cm. long	46
42. Awn wanting or less than 4 mm. long.....	43
42. Awn 4 mm. or more long	44
43. Spikelets about 1 cm. broad, Briza-like	7 <i>B. brizæformis</i> .
43. Spikelets narrower, not resembling those of Briza.....	29 α <i>B. unioloides hænkeanus</i> .
44. Flowering glumes scabrous-puberulent	45
44. Flowering glume smooth or merely scabrous.....	32 <i>B. polyanthus</i> .
45. A native of the southwest, Arizona, and southward. 35 ϵ <i>B. carinatus arizonicus</i> .	
45. A native of the northwest, Wyoming, Oregon, and northward.....	31 β <i>B. marginatus seminudus</i> .
46. Palea more than three-fourths the length of its glume.....	47
46. Palea three-fourths the length of its glume or less	29 <i>B. unioloides</i> .
47. Panicle rather lax and open, not dense	48
47. Panicle large, suberect, and rather dense	35 γ <i>B. carinatus densus</i> .
48. Plants with broad leaves, usually more than 7 dm. high	32 α <i>B. polyanthus paniculatus</i> .
48. Plants usually less than 7 dm. high with rather short, narrow leaves	36 <i>B. laciniatus</i> .
49. Awn distinctly twisted and divaricate.....	50
49. Awn not distinctly twisted and divaricate	52
50. Panicle short and dense.....	8 <i>B. scoparius</i> .
50. Panicle rather large and open	51
51. Spikelets usually more than 5 mm. broad in flower.....	6 <i>B. squarrosus</i> .
51. Spikelets 5 mm. or less broad in flower	5 <i>B. patulus</i> .
52. Panicle short and contracted	53
52. Panicle rather broad and open.....	56
53. Flowering glumes elliptic.....	3 β <i>B. hordeaceus glabrescens</i> .
53. Flowering glumes narrow-lanceolate	54
54. Awn 35 to 40 mm. or more long	11 <i>B. maximus</i> .
54. Awn less than 30 mm. long	55
55. Panicle forming a dense head rarely exceeding 5 cm. long	12 <i>B. rubens</i> .
55. Panicle less dense and usually longer	10 <i>B. madritensis</i> .
56. Flowering glumes elliptic or ovoid-lanceolate	57
56. Flowering glumes oblong lanceolate to narrow-lanceolate.....	60
57. Margins of flowering glumes not strongly involute in fruit	58
57. Margins of flowering glumes strongly involute in fruit	1 <i>B. secalinus</i> .
58. Panicle rather small and subracemose	2 <i>B. racemosus</i> .
58. Panicle rather large and broad.....	59

59. Spikelets less than 6 mm. broad in flower..... 4 *B. arvensis*.
 59. Spikelets more than 6 mm. broad in flower... 2 α *B. racemosus commutatus*.
 60. Awn more than 15 mm. long 61
 60. Awn much less than 15 mm. long, sometimes wanting..... 62
 61. Awn usually more than 35 mm. long..... 11 α *B. maximus gussoni*.
 61. Awn usually less than 30 mm. long 13 *B. sterilis*.
 62. Awn usually less than 3 mm. long..... 27 *B. inermis*.
 62. Awn usually more than 3 mm. long 16 α *B. ciliatus laeviglumis*.

I. BROMUS PROPER.

A. *Annuals or sometimes biennials with empty glumes rather broad and the flowering glume broadly elliptic to oblong-elliptic. Species all introduced.*

1. **BROMUS SECALINUS** L. Sp. Pl. 1: 76. 1753. *Serrafalcus secalinus* Bab. Man. Brit. Bot. 374. 1843. (Fig. 1.)

An erect annual. Culm 3-7 dm. high, smooth throughout or somewhat pubescent at the nodes. *Sheaths typically smooth*, sometimes the lowest sparsely pilose-pubescent;



FIG. 1.—*Bromus secalinus*: a, spikelet.

SPECIMENS EXAMINED.—*Maine*: N. Berwick (J. C. Parlin 566). *Ontario*: Galt (W. Herriott). *Connecticut*: Fairfield (E. H. Eames). *New York*: Oxford (F. V.

ligule about 1 mm. long, truncate, somewhat irregularly dentate; blades mostly 1-2 dm. long, linear-lanceolate, with coarse, sparse hairs above, smooth beneath. Panicle about 8-18 cm. long, at first erect, the upper part drooping in fruit, pyramidal in outline; lower branches 3-5, unequal. Spikelets ovoid-lanceolate, becoming somewhat laterally compressed and turgid in fruit, 10-18 mm. long,¹ 6-8 mm. broad in fruit; empty glumes smooth, obtuse, the lower 4-6 mm. long, 3-5-nerved, the upper broader, 6-7 mm. long, 7-nerved; flowering glumes 7-nerved, 6-8 mm. long, elliptic, obtuse, smooth or scabrous, having the margin strongly involute in fruit, shortly bidentate at the apex with the undulate awn mostly 3-5 mm. long, inserted about 1 mm. below the apex; palea equal to or only very slightly shorter than its glume.

General distribution: This species, introduced from Europe, is very generally distributed throughout the United States.

¹ All measurements of spikelets and glumes are exclusive of the awns.

Coville). *Pennsylvania*: Philadelphia (I. C. Martindale 15). *Delaware*: Centreville (A. Commons 135, 136). *Maryland*: Rocky Springs (J. E. Miller). *District of Columbia*: Washington (G. Vasey); (T. H. Kearney, jr.). *Florida*: Chipley (R. Combs 684). *Alabama*: Tuskegee (G. W. Carver). *Tennessee*: Hiwassee Gorge (T. H. Kearney, jr. 311). *Ohio*: Pittsfield (A. E. Ricksecker); Youngstown (R. H. Ingraham). *Indiana*: Millers (L. M. Umbach). *Michigan*: Thunder Bay Island (C. F. Wheeler). *Wisconsin*: Near Webster (L. S. Cheney 3430). *Minnesota*: Wilmar (W. D. Frost); Cannon Falls (J. H. Sandberg 327). *Iowa*: Minerva (C. R. Ball 9); Ames (C. R. Ball 35, 150); Newmarket (B. Shimek 12). *Missouri*: St. Louis (Drummond 647). *Texas*: Ennis (J. G. Smith); El Paso (E. A. Mearns 1479, 1482). *New Mexico*: Cliff (J. K. Metcalfe). *Arizona*: Near Flagstaff (D. T. McDougal 303). *Utah*: Provost (M. E. Jones 5499); Ogden (T. A. Williams 2482); Salt Lake City (M. E. Jones 1009). *Colorado*: Estes Park (J. Ball); near Silverton (C. L. Shear 1239). *Wyoming*: Near Beulah (David Griffiths 405). *Montana*: Bozeman (P. A. Rydberg 2214; C. L. Shear 453); Garrison (C. L. Shear 368). *Idaho*: Farmington Landing (Sandberg, Heller & McDougal 531); Forest (H. E. Brown 26). *Washington*: (Leiberg & Sandberg 399); Walla Walla (R. M. Horner 564); Walla Walla (C. L. Shear 1557, 1597). *Oregon*: McMinnville (C. L. Shear 1618); Corvallis (M. Craig 9344). *California*: Dixie Valley (J. B. Davy).

This plant is very closely related to several other species, especially *B. racemosus* and *B. arvensis*. It differs from both in the character of the spikelet at maturity, the florets being much spreading and the margin of the flowering glume being strongly involute.

2. BROMUS RACEMOSUS L. Sp. Pl. ed. 2. 1: 114. 1762. *Serrafalcus racemosus* Parl. Rar. Pl. Sic. 2: 14. 1840. (Fig. 2.)

An annual or biennial, with erect or ascending culm 3-7 dm. high, usually scabrous-puberulent just below the panicle and pubescent at the nodes. Sheaths rather densely pilose-pubescent, at least the lower ones; ligule about 1 mm. long, lacerate-dentate; blades linear, rather narrow, mostly 7-14 cm. long, pilose-pubescent below or on both surfaces. Panicle typically simple sometimes with 2-3 branches below, mostly somewhat nodding. Spikelets 15-20 mm. long, usually drooping in fruit, at first ovoid-lanceolate, becoming somewhat oblong-lanceolate, always acute, mostly 5-9-flowered; empty glumes broad, smooth or scabrous, the lower 3-5-nerved, 5-6 mm. long, the upper broader, 5-7-nerved, 6-8 mm. long; flowering glume elliptical, smooth, or scabrous, 7-nerved, 6-8 mm. long, very shortly bidentate at the apex, with a straight awn 5-8 mm. long inserted about 1 mm. below the apex; palea shorter than its glume. Introduced from Europe.

SPECIMENS EXAMINED.—*Cape Breton Island*: New Campbellton (D. White and Chas. Schubert 28). *Maine*: Foxcroft (M. L. Fernald 565). *Pennsylvania*: Bucks Co. (N. L. Britton); Philadelphia (C. E. Smith 41). *Delaware*: Centreville (A. Commons 137).

The validity of this species is uncertain. The only thing in Linnæus's original description to distinguish it from other closely related forms is the following: "Panicula constat racemo simplici: pedunculis alternis, sæpius solitarius . . ."

We have for the present accepted the interpretation and emendation of the species as given by Mertens and Koch in "Rehling's Deutschlands Flora 1²: 681." These authors state that the growing plant shows the greatest resemblance to *B. mollis*. It differs from that species, however, in its smooth spikelets and looser panicle. From *B. secalinus* it is said to always differ in the fruiting condition in having the margins of the flowering glumes flat and overlapping, or but very slightly involute toward the base, instead of having the florets spread and the margins strongly involute. It is also said to flower earlier and have more pubescence on

leaves and sheaths. Much of the material in the herbarium hitherto referred to this species belongs to *B. racemosus commutatus* and *B. secalinus*, and the western material especially is in great part *B. hordeaceus glabrescens*, which is distinguished by its denser panicle with shorter branches.

- 2α. **BROMUS RACEMOSUS COMMUTATUS** (Schräd.) Hook. f. Stud. Fl. Brit. Isl. 451. 1870. *Bromus commutatus* Schräd. Fl. Germ. 353. 1806. *Serrafalcus commutatus* Bab. Man. Brit. Bot. 374. 1843.

An annual or biennial, 3-7 dm. high, typically with a rather small panicle, but frequently, under favorable conditions of growth, with a panicle as large as that of

B. secalinus, but more drooping. It differs from the species in its rather larger spikelets and panicle, also rather broader flowering glumes with frequently a faint indication of an angle on the margin just above the middle. The spikelets 2-2.5 cm. long, 6-7 mm. wide, intermediate in size between *B. racemosus* and *B. squarrosus*; from the latter it differs in its straight awn also. From *B. arvensis* it is separated by its smaller drooping panicle and larger spikelets.

This plant seems to be quite generally introduced throughout the country, and especially in the East.

SPECIMENS EXAMINED.—*Massachusetts*: Essex Co. (Oakes). *Connecticut*: Fairfield (E. H. Eames). *New York*: Ithaca (F. V. Coville). *Pennsylvania*: Easton (T. C. Porter). *Maryland*: Marshall Hall (C. L. Pollard 303). *Ohio*: Oberlin (A. E. Ricksecker); Painesville (W. C. Werner). *Tennessee*: Knoxville (A. Ruth). *Michigan*: Agricultural College (C. F. Wheeler). *Iowa*: (L. H. Pammel 909). *Missouri*: Sheffield (B. F. Bush 599). *Washington*: Pull-



FIG. 2.—*Bromus racemosus*: a, lower portion of a spikelet; b, flowering glume, dorsal view.

man (A. D. E. Elmer 886); near Montesano (A. A. & E. G. Heller 3983). *Oregon*: Otis Creek (J. B. Leiber 2338).

3. **BROMUS HORDEACEUS** L. Sp. Pl. 1: 77. 1753. *Bromus mollis* L. Sp. Pl. ed. 2. 1: 112. 1762. *Serrafalcus mollis* Parl. Fl. Ital. 1: 395. 1848. (Fig. 3.)

An erect or ascending annual or biennial with a rather dense, erect panicle. Culms about 2-8 dm. high, usually somewhat pubescent at the nodes. Sheaths retrorsely soft pilose-pubescent; ligule 1.5-2 mm. long, laciniate; blades linear, varying from

pilose-pubescent to nearly smooth, about 5-15 cm. long and 3-5 mm. broad. *Panicle contracted*, narrow-pyramidal, 5-10 cm. long by 2-4 cm. broad; branches somewhat spreading in flower. Spikelets 5-13-flowered, ovate-lanceolate, *becoming obtuse*, 12-15 mm. long by 4-6 mm. wide, with short pedicels; empty glumes broad, obtuse, *coarsely pilose or scabrous-pubescent*, the lower 3-5-nerved, 4-6 mm. long, the upper 5-7-nerved, 7-8 mm. long; flowering glume broad, obtuse, 7-nerved, coarsely pilose or scabrous-pubescent, rather deeply bidentate, margin and apex hyaline, 8-9 mm. long; awn *rather stout*, rough, flattened toward the base, straight at first, *frequently somewhat twisted when old*, about 6-9 mm. long; palea a little more than $\frac{3}{4}$ the length of its glume.

A species native in southern Europe, introduced into this country, where it is very abundant on the Pacific coast, having taken possession of vast areas of the deteriorated semiarid range lands. It is also found sparingly on the Atlantic coast from Maine to Virginia.

SPECIMENS EXAMINED.—*Maine*: N. Berwick (J. C. Parlin 567). *New York*: Aurora (F. V. Coville in 1885). *Pennsylvania*: Philadelphia (I. C. Martindale 13 and 14). *Delaware*: Centerville (A. Commons 133). *Ohio*: Oberlin (A. E. Ricksecker 1895). *Montana*: Garrison (P. A. Rydberg 2126). *Utah*: Ogden (T. A. Williams 2495). *Idaho*: Clear Water River (Sandberg, Heller, McDougal 167). *Washington*: Walla Walla (C. L. Shear 1585; E. P. Sheldon 8140); Tacoma (A. B. Leckenby in 1898); Cascade Mts. (G. R. Vasey in 1889; Sandberg & Leiberger 172); Seattle (C. V. Piper 796). *Oregon*: Lexington (J. B. Leiberger 10). *California*: San Francisco (M. E. Jones 3270); Marin Co. (Dr. E. Palmer 2032, 2033); Berkeley (J. W. Blankinship 64); Santa Cruz (Dr. Anderson in 1887); Morley Station (J. B. Davy 1894); San Jose (H. A. Brainard in 1896); Pitt River (H. E. Brown 224); Mt. Shasta (H. E. Brown 374b).

There being nothing in the original descriptions of these species to separate them, we have adopted the older name on the authority of Munro, who states in his paper on "The Grasses of Linnaeus's Herbarium" that Linnaeus's specimens of the two, *B. hordeaceus* and *B. mollis*, are the same.

3α. BROMUS HORDEACEUS INTERMEDIUS (Guss.) n. comb. *Bromus intermedius* Guss. Fl. Sic. Prod. 1: 114. 1827. *Serrafalcus intermedius* Parl. Rar. Pl. Sic. 2: 17. 1840.

This differs from the species only in its slightly larger panicle and spikelets and awns, which are twisted and divaricate when mature and dry.



FIG. 3.—*Bromus hordeaceus*: a, empty glumes; b, flowering glume; c, palea.

Represented in the herbarium by a single specimen collected by Dr. L. D. Morse along a walk in San Mateo, California, June, 1898.

3β. BROMUS HORDEACEUS GLABRESCENS (Coss.) n. comb. *Bromus mollis glabrescens* Coss. Fl. Descr. Par. 654. 1845.

This differs from the species in having the spikelets glabrous or only scabrous throughout.

Like the species it is introduced on the east and west coasts.

SPECIMENS EXAMINED.—*Delaware*: Millsboro (A. Commons 132). *District of Columbia*: N. E. Washington (F. Blanchard). *California*: Marin County (Dr. E. Palmer

2033); New York Falls (G. Hansen 2080); San Francisco (Bolander). *Oregon*: Bonneville (W. M. Canby 26). *Washington*: Pullman (A. D. E. Elmer 876); no locality (E. P. Sheldon 8205 and G. R. Vasey).

4. BROMUS ARVENSIS L. Sp. Pl. 1: 77. 1753. *Serrafalcus arvensis* Parl. Fl. Ital. 1: 393. 1848. (Fig. 4.)

A tufted annual or biennial, somewhat geniculate at the base. Culm nearly or quite glabrous, about 3–6 dm. high. *Sheaths densely soft pubescent*; ligule about 2 mm. long, lacerate; blades linear, pubescent both sides. Panicle effuse, broad, apex somewhat drooping; *lower rays mostly 4–8*. Spikelets terete-acuminate at first, becoming slightly laterally compressed when old, about 7–11-flowered, 1.5–2.5 cm. long, 3–4 mm. broad, smooth or minutely scabrous throughout; empty glumes broad; the lower subacute 3–5-nerved, 4–5 mm. long; the upper about 7-nerved, obtuse, 5–6 mm. long; flowering glume 7–8 mm. long, broad, *obtus with the broad hyaline margin projecting slightly into an obtuse angle just above the middle*; apex hyaline, emarginate; awn inserted below the apex, 7–10 mm. long, *straight or slightly twisted when old*; palea shorter than its glume.

Type from Europe.

Introduced into this country in a few localities. Dr. Beal, in "Grasses of

North America," reports it from New Jersey and Michigan. The only American specimens we have seen are the following: *Missouri*: Sheffield, common along railroads (B. F. Bush 577 and 588).

This can scarcely be satisfactorily separated from *B. patulus* M & K., which see for the points of difference usually noted. It is also close to *B. racemosus commutatus*.



FIG. 4.—*Bromus arvensis*: a, empty glumes; b, part of a spikelet with the lower florets open showing the palea.

5. BROMUS PATULUS M. & K. in Roehl. Deutsch. Fl. 1: 684. 1823. *Serrafalcus patulus* Parl. Fl. Ital. 1: 394. 1848. (Fig. 5.)

An annual or biennial with culms smooth, erect, or somewhat geniculate at the base, about 4-6 dm. high. Sheaths softly pubescent; ligule 2-3 mm. long, subtruncate, lacinate-dentate; blades linear-lanceolate, pubescent throughout. Panicle 12-20 cm. long, very broadly pyramidal, diffuse, somewhat drooping; lower branches 3-5, slender, smooth; spikelets on slender pedicels, drooping, lanceolate to ovoid-lanceolate, terete at first, 2-2.5 cm. long, 5-6 mm. broad, becoming somewhat laterally compressed at maturity, smooth throughout; empty glumes rather broad, the lower narrower, acute, 3-nerved, 4-6 mm. long; the upper obtuse, 5-nerved, 6-8 mm. long; flowering glume 9-nerved, the marginal ones faint, 7-9 mm. long, broad, obtuse, with a hyaline margin obtusely angled above the middle and an emarginate apex; awn 8-10 mm. long, stout, somewhat twisted and strongly divaricate at maturity, inserted below the apex; palea conspicuously shorter than its glume.

Type from Austria.

Introduced in this country in a few places.

SPECIMENS EXAMINED. — *Massachusetts*: waste ground, Boston (C. W. Swan). *South Dakota*: Brookings (T. A. Williams). *Colorado*: Fort Collins (L. H. Pammel).

A species intermediate between *B. arvensis* and *B. squarrosus*. From the former it is distinguished by its somewhat larger, more compressed spikelets, rather stouter awn, strongly divergent at maturity, and earlier flowering period. From the latter it is distinguished by its narrower spikelets, larger panicle, and less conspicuous angle at the margin of the flowering glume. Perhaps but a variety of *B. arvensis*.

6. BROMUS SQUARROSUS L. Sp. Pl. 1: 76. 1753. *Serrafalcus squarrosus* Bah. Man. Brit. Bot. 375. 1843. (Fig. 6.)

A more or less tufted annual, 2-4 dm. high with a short, somewhat nodding panicle and densely soft pilose sheaths. Culms erect or slightly geniculate at the base, smooth. Sheaths densely retrorsely pilose-pubescent; ligule about 1 mm. long; blades linear, about 8-15 cm. long, 3-5 mm. wide, softly pubescent on both sides. Panicle usually 6-12 cm. long, open, branches ascending or drooping, frequently flex-



FIG. 5.—*Bromus patulus*: a, empty glumes; b, flowering glume.

uous. Spikelets oblong to oblong ovoid, turgid, 6-12-flowered, 15-20 mm. long; empty glumes broad, obtuse, glabrous, the lower 3- or indistinctly 5-nerved, $\frac{3}{4}$ - $\frac{1}{2}$ the length of the upper, the upper 7-9-nerved, 6-8 mm. long; flowering glume *very broad, 7-9-nerved, obtuse*, with a broad scarious margin somewhat obtusely angled above the middle, glabrous or minutely scabrous, apex minutely notched; awn *rather stout, attached below the apex*, about the length of the glume, *somewhat twisted and divergent, especially at maturity*; palea a little shorter than its glume. Adventive from Europe. Has been found in waste places on the eastern coast sec. Britton and Brown, "Illustrated Flora."

Type in Linnæus's herbarium.

SPECIMENS EXAMINED: A single specimen in the National Herbarium collected at Lansingburg, New York, by Dr. E. C. Howe in 1886, has been referred to this species, though it is not typical but approaches very closely *B. secalinus* and *arvensis*.

7. BROMUS BRIZÆ-FORMIS Fisch. & Mey.
Ind. Sem. Hort. Petrop.
3: 30. 1837. (Fig. 7.)

An erect annual with rather slender culms and *large drooping, brizæform spikelets*. Culms about 3-6 dm. high, smooth or slightly pubescent at the nodes. Sheaths with a soft, short-pilose pubescence, especially the lower ones; ligule about 2 mm. long, somewhat lacinate; blades linear, usually pubescent on both sides. Panicle 5-25 cm. long, lax, secund, mostly nodding. *Spikelets about 15-25 mm. broad, oblong-ovoid, laterally much compressed*; empty glumes broad, obtuse, smooth or minutely scabrous, frequently purplish, lower 3-5-nerved, about one-half the length of the upper, which is broader, 5-9-nerved and 6-8 mm. long; flowering glume



FIG. 6.—*Bromus squarrosus*: a, lower portion of a spikelet; b, dorsal view of a flowering glume.

about 1 cm. long, *very broad*, obtuse, smooth or slightly scabrous, with a broad scarious margin; awn none or sometimes present, especially on the upper flowering glumes, terminal, 1-2 mm. long; palea not quite equaling the glume, sparsely pectinate-ciliate on the keels.

Introduced. Most frequently met with on the west coast.

Type locality "in montibus Talüsch." (Caucasus Region?)

SPECIMENS EXAMINED.—*Massachusetts* (ex herb. W. P. Alcott in 1880). *New York*: Ithaca (W. R. Dudley in 1884). *Delaware*: Wilmington (A. Commons 339 in 1898). *Montana*: (F. Lamson-Scribner 97 in 1883). *Idaho*: Lewiston (A. A. & E. G. Heller 3203 in 1896; L. F. Henderson 4635 in 1894); *Viola* (Sandberg, Heller & McDougal 482 in 1892); *Cœur d'Alene Mountains* (J. B. Leiberg 1006 in 1895). *Utah*: Echo (P. A. Rydberg 2353 in 1895); *Salt Lake City* (L. H. Pam-mel 197 in 1899). *Nevada*: Reno (S. M. Tracy 194 in 1887). *Washington*: *Waitsburg* (R. M. Horner 563 in 1897); *Pullman* (A. D. E. Elmer 371 in 1896; 876 in 1897); *Wawawai* (C. V. Piper 1739 in 1894). *Oregon*: *Prineville* (J. B. Leiberg 308 in 1894). *California*: *Near Mount Shasta* (Dr. E. Palmer 2647 in 1892).

8. BROMUS SCOPARIUS L.
Cent. Pl. 1: 6. 1755. *Serrafal-cus scoparius* Parl. Fl. Pal. 1: 174. 1845. (Fig. 8.)

An annual with rather slender, smooth, nearly erect culms about 2-3 dm. high. Sheaths sparsely pilose or nearly smooth; ligule about 1 mm. long, lacinate-dentate; blades linear, 6-12 cm. long, mostly pilose above and smooth beneath. Panicle dense, oblong or ovate, obtuse, erect, 3-6 cm. long, 1-3 cm. broad; branches very short. Spikelets very short-pedicellate, oblong-lanceolate, 5-11-flowered, 10-18 mm. long; empty glumes glabrous or slightly scabrous on the nerves, the lower acute, 1-3-nerved, 4-5 mm. long, the upper 3-nerved, broader, 5-6 mm. long; flowering glume 7-8 mm. long, 5-nerved, varying from typically smooth to sometimes scabrous-pubescent, bidentate at the membranous apex; awn twisted, divaricate, 7-8 mm. long inserted 1.5-2 mm. below the apex; palea about 1 mm. shorter than its glume with the keels remotely ciliate-pectinate.

Type from Spain.

Indigenous in the Mediterranean region of Europe and Africa, adventive in California.

We have only one specimen in the herbarium, collected by J. W. Congdon, at Mariposa, California.

II. **NEOBROMUS** n. subgen.

Flowering glumes lanceolate, deeply bifid; awn twisted and bent below the middle.

The following species is the type of this subgenus:

9. BROMUS TRINII Desv. in Gay Fl. Chil. 6: 441. 1853. *Trisetum hirtum* Trin. *Linnaea*, 10: 300. 1835. Not *B. hirtus* Lichtst. 1817. *Trisetum barbatum* Steud.



FIG. 7.—*Bromus brizaformis*: a, a spikelet; b, empty glumes; c, flowering glume; d, palea.

Syn. Pl. Gram. 229. 1854. *Bromus barbatooides* Beal, Grass. N. A. 2: 614. 1896. *Avena symphicarpi* Trin. mss. (p. p.) sec. Desvaux l. c. (Fig. 9.)

An erect caespitose annual, usually branching below, mostly 3-6 dm. high. Culm smooth or pubescent at the nodes. Sheath usually pilose-pubescent, sometimes nearly smooth; ligule rounded or subtruncate, dentate, about 1 mm. long; blades linear to linear-lanceolate, 6-15 cm. long, 3-5 mm. wide, mostly pilose-pubescent throughout, sometimes nearly smooth. Panicle usually narrow and somewhat crowded, suberect, 8-20 cm. long; branches rather numerous, slender, ascending or diverging in fruit. Spikelets narrow, lanceolate at first, becoming spread and

oblong lanceolate in flower and fruit, mostly 5-7-flowered, 1.5-2 cm. long; empty glumes lanceolate, acuminate, or with a subulate prolongation, smooth, the lower 1-nerved, rarely 3-nerved, 8-11 mm. long, the upper broader, 3-nerved, rarely 5-nerved, 13-16 mm. long; flowering glume coarsely and sparsely pubescent, 5-nerved, 12-15 mm. long, acuminate, with two narrow teeth 2-3 mm. long; the pubescence on the callus is usually slightly denser and longer than on the glume; awn 15-20 mm. long, twisted below, bent below the middle and strongly divaricate when old.

Type from Chile.

General distribution: California to Colorado and south to Chile.

SPECIMENS EXAMINED. — *Utah*: Sitgreaves Pass, Camp 60 (Ives Expedition). *Nevada*: Near Horse Spring (M. E. Jones 5069f); valley of Virgin River, Lincoln County (Coville & Funston 1907). *California*: Los Angeles (S. M. Tracy 163; Kellogg & Harford 1087, 1094); near Pasadena (O. D. Allen, April 12, 1885); Panamint Mountains, Inyo County (Coville & Funston 506); near San Francisco (Bolander 6128).

This plant is apparently related to *B. scoparius* and *B. tectorum*, though differing in some respects from all species of *Bromus* and showing

close relationship with *Trisetum* and *Avena*, to both of which genera forms of it have been referred. It appears to us, however, nearest to *Bromus* by reason of its rather large numerous flowered spikelets, nearly closed sheath, and plicate grain adhering to the palea.

9α. **BROMUS TRINII PALLIDIFLORUS** Desv. in Gay Fl. Chil. 6: 441. 1853. *Bromus barbatooides sulcatus* Beal, Grass. N. A. 2: 615. 1896. *Trisetum barbatum major* Vas. in herb. and Beal l. c.



FIG. 8.—*Bromus scoparius*: a, empty glumes; b, portion of a spikelet, showing flowering glumes.

A more robust and larger plant, 6–12 dm. high, with a much elongated panicle mostly 2–4 dm. long; with branches mostly 6–12 at the lower whorls, weak and spreading; leaves broadly linear lanceolate, smooth or somewhat sparsely pilose-pubescent, as are also the sheaths.

Type from the Andes of southern Chile.

General distribution: Southern California to southern Chile.

SPECIMENS EXAMINED.—*California*: Near Pasadena (O. D. Allen in 1885); Chollos Valley, San Diego (C. R. Orcutt 1064); San Diego (D. Cleveland in 1882); San Nicholas Island (Blanche Trask 15).

9β. BROMUS TRINII EX-CELSUS n. var.

A stout perennial (?) 5–7 dm. high.

Leaves and sheaths short pilose-pubescent. Panicle rather narrow, nearly erect 1.5–2 dm. long; branches numerous, ascending, 2–8 cm. long. Spikelets *oblong-lanceolate*, *carinate*, 2–2.5 cm. long, 5–6 mm. wide; empty glumes lanceolate-acuminate, smooth, the lower 3-nerved, 13–15 mm. long; flowering glume 7-nerved, 10–12 mm. long, sparsely pilose-pubescent, bidentate at the acute apex; teeth 1–2 mm. long; *awn* 10–12 mm. long, somewhat twisted at the base, and divaricate.

Type No. 522, collected by Coville & Funston in the Panamint Mountains, Inyo County, California; altitude 1,700 m.

This plant, which is the only one of this form seen, is somewhat anomalous and may prove to be a good species. The spikelets and glumes are conspicuously wider than in the species, the florets more crowded, and the awn shorter.



III. STENOBROMUS Griseb.

FIG. 9.—*Bromus trinii*: a, empty glumes; b, portion of a spikelet showing flowering glumes.

Annual or biennial plants, with mostly narrow spikelets and glumes and rather long awns. Chiefly natives of the Mediterranean region of Europe and Africa. Introduced in this country.

10. BROMUS MADRITENSIS L. Cent. Pl. 1 : 5. 1755. (Fig. 10.)

A tufted annual, with an erect, rather dense panicle. Culm 3–7 dm. high, erect or somewhat geniculate at the base, smooth. Sheaths smooth or the lower slightly pubescent; ligule about 2 mm. long, subtruncate and lacerate; blades linear, puberulent or nearly smooth, 5–15 cm. long, 2–4 mm. wide. Panicle *erect*, 5–12 cm. long, *oblong-ovoid* in outline, lower branches 2–4, 1–3 cm. long, unequal, some-

what spreading in flower, slender and somewhat swollen at the base of the spikelets. Spikelets 3-4 cm. long exclusive of awns, nearly smooth to scabrous-puberulent, 7-11 flowered; empty glumes lanceolate, acuminate, the lower 1-nerved, 9-12 mm. long, the upper 3-nerved, 13-16 mm. long; flowering glume linear-lanceolate, 15-18 mm. long, usually glabrous or merely scabrous, somewhat curved outward when old, distinctly 3 or faintly 5-7-nerved, with two acute hyaline teeth, 2-3 mm. long, and a rather stout, tapering, rough, somewhat curved awn about 16-22 mm. long; palea reaching about to the point of the insertion of the awn, pectinate-ciliate on the keels.

A species introduced from Europe rather widely distributed in California and reported from Michigan by Beal in "Grasses of North America."

SPECIMENS EXAMINED.—*California*: San Jose (H. A. Brainard); near Antioch (J. Burt Davy 111); Ft. Tejon (S. B. Parish 1994); New York Falls, Amador County (Geo. Hansen 2123).

11. BROMUS MAXIMUS
Desf. Fl. Atl. 1: 95. t. 26.
1798. (Fig. 11.)

An erect or ascending annual, 2-4 dm. high, with a smooth culm. Sheaths pilose-pubescent; ligule 3-4 mm. long, rounded above, lacerate; blades flat, linear, 3-5 mm. broad and about 2-3 dm. long, pilose both sides. Panicle erect, somewhat secund and narrow, open in flower, closing more or less afterwards, 5-10 cm. long, lower branches 2-3, about 1.2 cm. long, bearing 1-2 spikelets. Spikelets usually 5-7-flowered, 3.5-5 cm. long, exclusive of the awns, terete or somewhat laterally compressed at maturity; empty glumes smooth, lanceolate, acuminate, the lower 15-20 mm. long, strongly 1-nerved, margin hyaline, the upper broader, 25-30 mm. long,



FIG. 10.—*Bromus madritensis*: a, empty glumes and two lower florets; b, flowering glume with part of the awn.

prominently 3-nerved; flowering glume 5-nerved, 25-30 mm. long, harshly scabrous to scabrous-puberulent, 2-toothed at the apex; teeth hyaline, acute, about 3-4 mm. long, awn stout, 3.5-4.5 cm. long, very rough, tapering toward the end, inserted just below the teeth; palea somewhat shorter than its glume; rachilla slender, puberulent, about 3 mm. long.

Type from northern Africa

SPECIMENS EXAMINED.—*California*: Stanford University (C. Ritter 305); (J. B. Davy in 1894).

There are several names antedating the above which are regarded by some European authorities as synonymous. *B. rigidus* Roth, Poem. & Ust. Mag. Bot. 10: 21. 1790 is one. This has been adopted by Dr. Beal (Grass. N. A. 2: 611. 1896). A careful study of the original description of this species, however, leads us to believe that the plant should at least be separated as a variety. The following quotations from Roth's description l. c. indicate the chief points of difference: "Culmi . . . primus erecti, demum procumbentes, panicula . . . spiculis . . . 10 ad 12 floribus compositis; corollae valvula exterior . . . hirsuta."

The most important difference between our plants as well as the European specimens examined and the above description is in the hirsute flowering glume. Mertens and Koch in Roehl. Deutsch. Fl. 1: 689. 1823, say that they received a specimen from Roth himself having smooth spikelets, thus showing that he regarded such forms as belonging to his species. Notwithstanding this these authors, l. c., p. 691, regard *B. maximus* as at least varietally separate from *B. rigidus*, so it seems to us best to retain for the present for our plant Desfontaine's name. *Bromus incrassatus* Lam. Enc. 1: 468. 1783, and *B. rigens* L. Mant. 1: 33. 1767, are also doubtful synonyms.

11a. **BROMUS MAXIMUS GUSSONI** Parl. Fl. Ital. 1: 407. 1848. *Bromus gussoni* Parl. Rar. Pl. Sic. 2: 8. 1840. *Bromus sterilis* Guss. Fl. Sic. Prod. Suppl. 1: 27. 1832. Not L. 1753.

Differs from the species in its larger size, 4-7 dm. tall, larger and more lax panicle, 1-2 dm. long, with the upper part somewhat drooping.

An introduced plant occurring in Arizona, California, and Washington.



SPECIMENS EXAMINED.—*Arizona*: FIG. 11.—*Bromus maximus*: a, empty glumes with a floret; Near Fort Huachuca (T. E. Wilcox 172); Huachuca Mt.

(J. G. Lemmon and wife 3107). *California*: Avalon, Santa Catalina Island (Blanche Trask in 1898); San Francisco (Bolander); San Jose (H. A. Brainard, in 1896); San Diego (C. R. Orcutt 1059); Woodland (J. W. Blankinship 39 and 40); Berkeley County (J. W. Blankinship 38); Clear Creek, Butte County (H. E. Brown 199); Chico (E. Palmer 2034); New York Falls, Amador County (G. Hansen 598); near San Bernardino (J. B. Leiberg 3323). *Washington*: Tacoma (A. B. Leckenby in 1898).

12. BROMUS RUBENS L. Cent. Pl. 1: 5. 1755. *Festuca rubens* Pers. Syn. Pl. 1: 94. 1805. (Fig. 12.)

A rather slender, tufted annual. Culm about 2-5 dm. high, erect or slightly geniculate at the base, puberulent toward the top. Sheaths pubescent, ligule 1-2 mm. long, lacinate-dentate; blades 3-15 cm. long, linear-lanceolate, pubescent both sides. Panicle erect, compact, ovoid, usually purplish, about 4-7 cm. long. Spikelets mostly 7-11-flowered, 2-2.5 cm. long; empty glumes acuminate, smooth to scabrous, pubescent, the lower narrow, 1-nerved, 7-9 mm. long, the upper broader, 3-nerved, 10-12 mm. long; flowering glume 13-16 mm. long, lanceolate acute, 5-nerved, scabrous to appressed, scabrous-pubescent, somewhat bent outward when mature, apex deeply cleft into two long-acuminate hyaline teeth 4-5 mm.

long; awn straight, 18-21 mm. long; palea reaching about to the point of insertion of the awn, long ciliate-pectinate on the keels.

A species from the Mediterranean region of Europe introduced on the Pacific coast and reported by Beal as being found in Kansas. A single specimen has been seen from the Atlantic coast on wool waste near Boston, Mass.

SPECIMENS EXAMINED.—*California*: Volcano, Amador County (George Hansen 2078); near Santa Ana (A. Davidson 1973); Santa Catalina Island (Blanche Trask 12; T. A. Brandegee); Berkeley (J. W. Blankinship 36); Capay (J. W. Blankinship 37). *Oregon*: Gilliam County (J. B. Leiberger 163). *Massachusetts*: N. Billerica (C. W. Swan).

This species is closely related to *B. madritensis*, but is smaller throughout and has a more compact panicle.

13. BROMUS STERILIS L. Sp. Pl. 1: 77. 1753. *Schedonorus sterilis* Fr. Summ. Veg. Scand. 1: 76. 1846-49. (Fig. 13.)

An annual or biennial with rather stout, smooth, erect or ascending culms, 5-10 dm. high, more or less geniculate or curved at the base.

Sheaths mostly pubescent; ligule

1-1.5 mm. long, lacinate; blades broadly linear, usually pubescent throughout. Panicle 1-2 dm. long, broad, lax, drooping; lower branches 2-6, long and slender, rarely bearing more than one spikelet. Spikelets drooping, 2.5-3.5 cm. long, 6-10-flowered, linear-elliptical before flowering, becoming oblong and enlarged upward during flowering, and finally oblong-cuneiform with flattened sides and subdistal florets; empty glumes lanceolate-subulate, smooth or scabrous, the lower 1-nerved, 7-9 mm. long, the upper 3-nerved, 11-13 mm. long; flowering glume linear-lanceolate, 5-7-nerved, 17-20 mm. long, scabrous or scabrous-puberulent, deeply bidentate; teeth hyaline, subulate, about 2 mm. long; awn stout, tapering, very rough, 2-3 cm. long; palea considerably shorter than its glume.



FIG. 12.—*Bromus rubens*: a, empty glumes; b, portion of a spikelet showing flowering glume with portion of the awn, also the palea.

A species introduced from southern Europe, quite frequent on the Atlantic and Pacific coasts.

SPECIMENS EXAMINED.—*Massachusetts*: Boston (C. W. Swan). *New York*: Taughannock (K. M. Wiegand; F. V. Coville). *Pennsylvania*: Easton (A. P. Garber; T. C. Porter); Philadelphia (C. E. Smith 40). *Delaware*: Wilmington (A. Commons 17). *District of Columbia*: North Brookland (T. Holm). *Ohio*: Painesville (W. C. Werner). *British Columbia*: Vancouver Island (J. Macoun 117). *Washington*: Pullman (C. V. Piper 2554); Walla Walla (C. L. Shear 1616).

- 14. *BROMUS TECTORUM*** L. Sp. Pl. 1: 77. 1753. *Schedonorus tectorum* Fr. Summ. Veg. Scand. 1: 76. 1846-49. (Fig. 14.)

A tufted annual mostly 3-6 dm. high, erect or somewhat geniculate at the base. Culm smooth, rather slender. Sheaths pubescent; ligule membranous, 2-3 mm. long, much torn; blades linear, narrow, mostly pubescent throughout. Panicle broad, rather dense, secund, drooping, about 6-15 cm. long, branches subcapillary. Spikelets nodding, linear at first, spreading above in flower and becoming cuneiform, 13-20 mm. long; empty glumes acute, scabrous or pubescent, the lower narrow, 1-nerved, 4-6 mm. long, the upper 3-nerved, broader, 8-10 mm. long; flowering glume lanceolate, acute, scabrous-pubescent to short pilose-pubescent, 5-nerved, 11-13 mm. long with two narrow hyaline teeth at the apex and a straight awn about 13-15 mm. long; palea shorter than its glume.

A species from Europe quite generally distributed in this country, especially in waste places about cities.

SPECIMENS EXAMINED.—*Massachusetts*: Cambridge (J. W. Blankinship; A. K. Harrison 28); Essex County (W. P. Conant). *Rhode Island*: Providence (J. F. Collins). *New Jersey*: Weehauken (Wm. N. Van Sickle). *Pennsylvania*: Easton (T. C. Porter). *Delaware*: Wilmington (A. Commons 16). *District of Columbia*: Washington (C. L. Pollard 426). *Virginia*: Alexandria (T. Holm). *Indiana*: Pine (L. M. Umbach). *Mississippi*: Starkville (S. M. Tracy 1746). *Colorado*: Fort Collins (E. D. Ball; C. S. Crandall 526). *Utah*: Ogden (T. A. Williams 2496); Provo (M. E. Jones 5503). *Washington*: (Sandberg & Leiberger 191); Pasco (A. D. E. Elmer 1047).

This species is nearly related to *B. sterilis*, but is much smaller in every way and has a denser panicle.



FIG. 13.—*Bromus sterilis*: a, Empty glumes and a floret; b, dorsal view of a flowering glume with portion of the awn.

IV. ZERNA Panz. emend.

Nearly all native short-lived perennials, with but few exceptions, having a weak drooping panicle and more or less pubescent flowering glumes, frequently with the pubescence unevenly distributed.

A. Panicle lax and drooping.

15. **BROMUS RAMOSUS** Huds. Fl. Angl. ed. 1. 40. 1762. *Bromus asper* Murr. Prod. Stirp. Gött. 42. 1770. (Fig. 15.)



FIG. 14.—*Bromus tectorum*: a, Empty glumes; b, portion of a spikelet showing flowering glumes and portion of the awns.

A rather stout, erect, loosely caespitose perennial with a rather long, loose, nodding panicle. Culms about 10–15 dm. high, smooth or slightly rough pubescent just below the nodes, rather slender. Sheaths shorter than the internodes, clothed with abundant, rather stiff subretorse hairs; ligule about 2 mm. long, laciniate; blades broadly linear, about 2–3 dm. long and 8–12 mm. wide, sparsely pilose on the nerves beneath, harshly scabrous or subpilose above. Panicle 2–3 dm. long, open, loose, the branches distant, usually drooping. Spikelets about 6–10-flowered, narrow, 2–3 cm. long; empty glumes narrow, scabrous on the nerves, lower 1-nerved, a little more than one-half the length of the upper, upper 3-nerved, acute or mucronate, 9–11 mm. long; flowering glume 12–15 mm. long, acute, two-toothed at the apex, scarious margined, distinctly 3-nerved, scabrous on the nerves, shortly hispid from the outer nerves to the margin and on the lower portion of the keel; awn slender, straight, 7–9 mm. long; palea a little more than three-fourths the length of its glume, ciliate-pectinate on the keels.

A species introduced from Europe. It is said in Britton and Brown's "Illustrated Flora" to be distributed from New Brunswick to Michi-

gan and Kentucky. We have no American specimens in the National Herbarium, and have drawn the above description from European material. Dr. H. Trimen (Journ. Bot. 8: 376. 1870) has been followed in adopting Hudson's name for this plant, which does not seem to have been different from Murray's. (Cf. Dr. Trimen l. c. for further synonymy.)

This species is very closely related to *B. ciliatus* and has possibly been confused with it. It is usually distinguished by its rougher pilose-hispid sheaths and longer flowering glume and awn. The panicle is usually looser and with fewer spikelets.

16. **BROMUS CILIATUS** L. Sp. Pl. 1: 76. 1753. *Bromus canadensis* Mx. Fl. Bor. Am. 1: 65. 1803. (Fig. 16.)

A tall, rather slender, leafy perennial with a broad, lax, drooping panicle. Culms erect, smooth or slightly pubescent at the dark nodes, about 7-12 dm. high. Sheaths retrorsely short-pilose or nearly smooth, coarsely striate; ligule very short, rarely exceeding 1 mm.; blades rather broadly linear-lanceolate, weak, about 2.5-3.5 dm. long and 1 cm. broad, typically sparsely pilose on both sides, but sometimes almost smooth. Panicle very broadly pyramidal, about 1.5-2.5 dm. long; lower branches 2-4 long, slender, flexuous, drooping. Spikelets narrow, 5-9-flowered, 15-22 mm. long on slender, flexuous pedicels; empty glumes narrow, smooth; the lower 1-nerved, acute, 5-8 mm. long; the upper broader, obtuse, 8-11 mm. long, 3-nerved; flowering glumes narrow, oblong-lanceolate, obtuse and slightly bifid at the apex, distinctly 3 or faintly 5-7-nerved, ciliate-pubescent on each side from the outer nerve to the margin for about three-fourths the length, 10-12 mm. long; awn slender, straight, 3-5 mm. long; palea narrow, nearly equaling the glume; rachilla slender, thinly pubescent.

General distribution: Newfoundland to New York, west to Manitoba and Minnesota.

Type grown at Upsala, Sweden, from seed sent from Canada by Kalm.

SPECIMENS EXAMINED.—*Newfoundland*: Shoal Point (A. Waghorne 49); Chimney Cove (A. Waghorne 48); Exploits River (Robinson and Schrenk in 1894). *Northwest Territory*: Severn River (J. M. Macoun in 1886). *Manitoba*: Brandon (J. M. Macoun 13042). *Maine*: East Auburn (E. D. Merrill 18, 24, 33, 34); ex herb. M. S. C. (Jackman 6); Van Buren (M. L. Fernald 195); Cape Elizabeth (E. E. Gayle 873). *New Hampshire*: Jaffrey (B. L. Robinson 336). *Vermont*: Manchester (M. A. Day 214, 217). *Massachusetts*: Ipswich (Oakes). *New York*: McKenzie Pond (C. H. Peck 9); South Branch (F. Tweedy in 1879); (W. R. Dudley in 1884); Lebanon Springs (A. K. Harrison 44); Oriskany (Geo. Vasey in 1841). *Michigan*: Keweenaw Point (F. E. Wood 3515); Rochester (O. A. Farwell 536a—a small form). *Wisconsin*: Tomahawk (L. S. Cheney 2198). *Minnesota*: (F. F. Wood 1889).

Linnaeus's good description of this species leaves little chance for doubt as to the identity of the plant. According to Dr. Gray, *Bromus kalmii* in Linnaeus's her-



FIG. 15.—*Bromus ramosus*: a, Empty glumes; b, the florets.

barium is labelled *B. ciliatus*, and this fact led to some confusion by Muhlenberg and Torrey. Our plant is very closely related to *B. ramosus*. In the Black Hills, Manitoba, and Northwest Territory it passes by various intermediate forms through *B. richardsoni pallidus* into *B. richardsoni*. It is also connected by various gradations with *B. purgans*, so that like nearly all of our species it can only be separated arbitrarily.

16α. **BROMUS CILIATUS LÆVIGLUMIS** Scribn. in herb. n. var.

This differs from the species chiefly in having the flowering glumes entirely smooth or with a very slight amount of pubescence on the margin at the base. The type specimen has a somewhat narrower and less drooping panicle than the

species, but other plants referred to below have about the typical *B. ciliatus* panicle.

Type collected by W. Herriott, Galt, Ontario, Canada, July, 1898.

SPECIMENS EXAMINED.—*Maine*: Dead River (Fernald & Strong 488). *North Carolina*: Magnetic City (A. G. Weatherby 197 and 140); Swain County (Beardslee & Kofoed 9).

17. **BROMUS RICHARDSONI**

Link, Hort. Berol. 2: 281. 1833. *Bromus purgans longispicata* Hook. Fl. Bor. Am. 2: 262. 1840. *Bromus ciliatus scariosus* Scribn. U. S. Dept. Agr. Div. Agros. Bul. 13: 46. 1898. (Fig. 17.)

An erect, robust, tufted, short-lived perennial, about 6–13 dm. high. Culm smooth. Sheaths typically smooth below and pilose at the throat, sometimes scantily pilose throughout; ligule truncate, lacerate, 1–2 mm. long; blades linear-lanceolate, 15–25 cm. long and about 5–12 mm. broad, mostly scabrous above and glabrous beneath. Panicle usually large, effuse, and drooping, about 15–25 cm. long.



FIG. 16.—*Bromus ciliatus*: a, empty glumes; b, dorsal view of a flowering glume; c, palea.

Spikelets drooping terete-acuminate at first, becoming oblong-lanceolate and laterally compressed, mostly 2–3 cm. long, 6–11-flowered; empty glumes smooth, the lower acuminate; 1-nerved or rarely with two faint lateral nerves, 8–10 mm. long; the upper 3- or rarely 5-nerved, 9–12 mm. long, obtuse, or inequilateral and mucronate; flowering glume obtuse, emarginate, 7-nerved, 12–15 mm. long, appressed ciliate-pubescent from the second nerve to the margin and nearly to the apex, also across the back at the base; awn straight 3–5 mm. long; palea slightly shorter than its glume.

Type in the collection of the Royal Botanical Museum, Berlin, grown from seed sent by Dr. Richardson from western North America.

General distribution: Arizona and New Mexico, north in the mountains to British America.

SPECIMENS EXAMINED.—*Arizona*: Chiricahua Mountains (J. W. Toumey 31); Tucson (J. W. Toumey 752); San Francisco Mountains (J. G. Lemmon 3194); Rincon Mountains (G. C. Nealley 88). *New Mexico*: (Dr. G. Vasey); White Mountains (E. O. Wooton 332). *Utah*: Provo (S. M. Tracy 404); Aquarius Plateau (L. F. Ward 431); Mount Ellen (M. E. Jones 5684 bf); Alta (M. E. Jones 1132). *Colorado*: Georgetown (P. A. Rydberg 2381; C. L. Shear 610, 6244; S. M. Tracy 457); Marshall Pass (F. E. Clements 216; C. L. Shear 918); Breckenridge (C. L. Shear 1078); Sheep Horn Divide (Shear & Bessey 1541, 1539, 1548); Grand Lake (Shear & Bessey 1522); Durango (F. Tweedy 389); Ouray (C. L. Shear 1153); Buffalo Pass (Shear & Bessey 1433); Red Mountain (C. L. Shear 1204); West Mancos (Tracy, Earle & Baker 332); Dix (Tracy, Earle & Baker 4298); Upper La Plata (Tracy, Earle & Baker 987, 4303); Silver Plume (P. A. Rydberg 2466; C. L. Shear 679, 711); Buckeye canyon (G. H. French); Glenwood Springs (Shear & Bessey 1301); Robinson (C. L. Shear 1050); Red Cliff (Shear & Bessey 1281, 1284; Patterson 30); Florissant (T. A. Williams 2207); Pikes Peak (T. A. Williams 2222, 2173; Crandall & Cowen 542); Manitou (C. L. Shear 761); Cameron Pass (C. S. Crandall 116); McCoy's (Shear & Bessey 1334); Villa Grove (C. L. Shear 877). *Wyoming*: Welcome (T. A. Williams 2668, 2673a); La Plata Mines (E. Nelson 5087); Sheep Mountain (T. A. Williams 2305); Cooper Hill (A. Nelson 4407); Battle Lake (A. Nelson 4022); Cement Creek, Big Horn Co. (F. Tweedy 67). *Yellowstone National Park*: Near Mammoth Hot Springs (F. H. Burgelhaus). *Montana*: Belt Mountains (F. L. Scribner 411); Hound Creek (F. L. Scribner 14).



FIG. 17.—*Bromus richardsoni*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

Through the kindness of Dr. I. Urban we have been able to examine a part of the type of this species which has not heretofore been recognized by American botanists so far as we know. This species includes the great bulk of the material from the Rocky Mountains hitherto referred to *B. ciliatus*, into which it
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passes in British America. It is distinguished in general from *B. ciliatus* by its denser panicle, usually smooth leaves and sheaths and broader, more obtuse flowering glume, with more pubescence. Forms also occur connecting it with *B. porteri*. An examination of a spikelet from Hooker's type of *B. purgans longispicata* l. c. collected by Drummond in the Rocky Mountains shows it to be the same as *B. richardsoni*.

17α. BROMUS RICHARDSONI PALLIDUS (Hook.) n. comb. *Bromus purgans pallidus* Hook. Fl. Bor. Am. 2: 252. 1840.

This in its typical form is distinguished from the species by the *silky-villous margin of the flowering glume*, pale green, narrower spikelets, and smaller, denser panicle. The leaves are also usually less numerous and narrower.

Type in the herbarium of the Royal Gardens, Kew, England, collected by Drummond in the Rocky Mountains.

General distribution: Western Nebraska, Colorado, and Nevada north to the Arctic coast.

SPECIMENS EXAMINED.—*Nebraska*: near Mullen (P. A. Rydberg 1404). *Colorado*: Grand Lake (Shear & Bessey 1525); Villa Grove (C. L. Shear 879); Gunnison (S. M. Tracy 442). *Nevada*: E. Humboldt Mount (Watson 1328). *Oregon*: Fort Klamath (J. B. Leiberger 670); Wallowa (C. L. Shear 1819); (W. C. Cusick 1289); Powder River Mountains (C. V. Piper 2528). *Washington*: Loomiston (A. D. E. Elmer 559). *Idaho*: Beaver Canyon (P. A. Rydberg 2329). *Montana*: East Gallatin Swamp (P. A. Rydberg 3170); Manhattan (C. L. Shear 431); Madison River (P. A. Rydberg 2275); Spanish Basin (P. A. Rydberg 3114); Sheep Creek (P. A. Rydberg 3304); Columbia Falls (R. S. Williams 605). *Yellowstone National Park*: Slough Creek (F. Tweedy 589). *Wyoming*: Ten Sleep (T. A. Williams 2832). *South Dakota*: Sylvan Lake (David Griffiths 721); Rochford (P. A. Rydberg 1166). *Saskatchewan*: (J. Macoun 79); Prairie Albert (J. Macoun 13045). *Alberta*: near Banff (J. Macoun 26). *British Columbia*: Elk River (R. Kennicott). *Northwest Territories*: Fort Resolution (R. Kennicott).

The examination of a spikelet from the type specimen of this variety shows that it is intermediate between *B. richardsoni* and *B. ciliatus* and intergrades with both. Its denser panicle, fewer, narrower, and smoother leaves with the longer, silky pubescence of the flowering glume separate it in its typical form from the latter species. It sometimes resembles *B. porteri* in everything but the distribution and character of the pubescence of the flowering glume.

18. BROMUS KALMII A. Gray, Man. Bot. 600. 1848. *Bromus ciliatus* Muhl. Gram. 169. 1817. Not L. 1753. *Bromus purgans* Torr. Fl. N. Y. 2: 468. 1843. Not L. 1753. (Fig. 18.)

An erect, rather slender perennial with a drooping panicle. Culm 5–9 dm. high, usually pubescent just below the nodes. Culm leaves about 3: sheaths usually shorter than the internodes, moderately retrorsely pilose-pubescent, at least the lower ones; ligule about .5 mm. long, truncate, laciniate; blades flat, broadly linear-lanceolate, 7–17 cm. long, 5–10 mm. broad, usually sparsely pilose-pubescent both sides, rarely nearly smooth or scabrous. Panicle small, rather crowded, 5–15 cm. long, average about 10 cm.; lower branches 2–3, very slender and somewhat flexuous, bearing 1–2 spikelets. Spikelets drooping, oblong-ovoid, closely 7–13-flowered, 1.5–2.5 cm. long, 5–6 mm. broad; empty glumes coarsely pubescent, the lower linear-lanceolate, 3-nerved, 5–6 mm. long, the upper broader, obtuse, 7–8 mm. long, 5-nerved, the outer nerves sometimes indistinct; flowering glumes obtuse, emarginate, densely and coarsely silky-pubescent, 7-nerved, 8–10 mm. long; awn straight, 2–3 mm. long; palea a little shorter than the glume; joints of the rachilla pubescent, 1–1.5 mm. long.

Type: There seems to be no particular specimen designated as the type of this species by Dr. Gray. The sheet in the Gray herbarium, regarded as that upon which the original description was founded, contains portions of plants from three different localities, two from New York and one from Michigan, varying however but very little from each other. These were taken as the basis of the above description.

General distribution: New England to Minnesota.

SPECIMENS EXAMINED.—*New York*: Sodus Bay (O. E. Pearce in 1884); Ithaca (K. M. Wiegand in 1895; F. V. Coville in 1885). *Pennsylvania*: Easton (A. P. Garber in 1867 and 1868; T. C. Porter, in 1868, 1891, and 1897). *Wisconsin*: Valley of Wisconsin River (L. D. Cheney 2031); (Dr. G. Vasey in 1883); Madison (T. J. Hale in 18—). *Minnesota*: St. Cloud (E. V. Campbell 55 and 56); Turtle Lake (E. P. Sheldon in 1892); Zumbrota (E. A. Mearns 775); Lake Minnewaska (L. R. Moyer 1b).

19. *BROMUS PORTERI*

(Coul.) Nash; *Bromus kalmii porteri* Coul. Man. Bot. Ry. Mt. Reg. 425. 1885; *Bromus porteri* Nash. Bul. Torr. Bot. Club, 22: 512. 1895; *Bromus kalmii occidentalis* Vas. in Beal Grass. N. A. 2: 625. 1896; *Bromus ciliatus montanus* Vas. in Beal Grass. N. A. 2: 619. 1896. not *Bromus montanus* Retz. 1779; *Bromus kalmii* of most auct. amer.; *Bromus kalmii major* Vas. in herb. (Fig. 19.)

A tufted short-lived perennial with rather slender, erect culms about 5–9 dm. high, slightly puberulent toward the top and pubescent at the nodes, bearing from 3–4 leaves. Sheath scantily short pilose or smooth, usually shorter than the internodes; ligule 1 mm. or less long, truncate, dentate; blades of the culm about 7–14 cm. long by 3–5 mm. wide, linear-lanceolate, somewhat erect, rather distant and usually scabrous, those of the innovations longer and narrower. Panicle 8–20 cm. long, averaging about 12 cm., drooping, lower branches mostly 2–4, subcapillary. Spikelets terete-lanceolate before flowering, 2–2.5 cm. long, usually 7–9 flowered; empty glumes mostly obtuse, short-pubescent or sometimes nearly smooth, lower 5–7 mm. long, narrower, sometimes subacute, usually 3-nerved but



FIG. 18.—*Bromus kalmii*.

lateral nerves rather short, inconspicuous and sometimes wanting; the upper 7-9 mm. long, distinctly 3-nerved, obtuse; flowering glume 11-13 mm. long, broad-lanceolate, rather coarsely pubescent, apex hyaline, entire, or slightly emarginate; awn 2-4 mm. long, inserted just below the apex; palea mostly slightly shorter than its glume.

Type: The following specimens are cited with the original description l c. "Colorado, at Twin Lakes (Porter), Buffalo Peaks, and Sierra Madre Range (Coulter)."

Specimens from both the collections referred to have been seen and the above description based on them.

General distribution: Arizona and New Mexico north to Manitoba and west to Alberta. Found in its most characteristic form in the Rocky Mountains at an altitude of 2-3000 meters.



FIG. 19.—*Bromus porteri*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

SPECIMENS EXAMINED. — *Arizona*: Huachuca Mountains (F. X. Holzner 2164); a large form not typical; Tucson (J. W. Toumey). *New Mexico*: Glorieta (G. R. Vasey). *Colorado*: Steamboat Springs (Alice Eastwood 20); Mancos (Tracy, Earle & Baker 104, 382, 432); Silverton (C. L. Shear 1216); West Mancos Canyon (Tracy, Earle & Baker 332); Fort Collins Gulch (L. H. Pammel); North Park (C. F. Baker 24, 49; C. S. Sheldon 177); Sheep Horn Divide (Shear & Bessey 1540); Red Dirt Divide, Routt County (Shear & Bessey 1350, 1355); Marshall Pass (S. M. Tracy 459; C. L. Shear 934); Garland (C. L. Shear 854; G. Vasey); Crested Butte (Alice Eastwood 10a); Robinson (C. L. Shear 1054); Durango (Tracy, Earle & Baker 986, 4302); West Cliff (C. L. Shear 993); Twin Lakes (John Wolfe 1155-6); Gunnison (S. M. Tracy

442); Harmons Lake (Tracy, Earle & Baker 4300). *Utah*: Fish Lake (M. E. Jones 5743); Bromide Pass (M. E. Jones 5699bb); Above Kings Meadows (L. F. Ward 313); Cashe Junction (C. L. Shear 597); Aquarius Plateau (L. F. Ward 431). *Wyoming*: Sundance (Griffiths 420, 423, 436, 946; T. A. Williams 2604); Little Missouri Buttes (D. Griffiths 584); Bear Lodge Mountains (T. A. Williams 2642); Wind River (W. H. Forwood); Evanston (G. W. Letterman 3; T. A. Williams 2395, 2424); Elk Mountain (A. Nelson 4083); Gros Ventre (F. Tweedy 66); Woods Landing (A. Nelson 3922, 3848); Meeteetse Creek (T. A. Williams 2879); Spread Creek (F.

Tweedy 63); Tongue River Basin (B. C. Buffum 5116); Hulett (D. G. Griffiths 924); Big Horn Mountains (W. H. Forwood); Little Laramie River (T. A. Williams 2239); Seminole Mountains (E. Nelson 4931); Sand Creek (A. Nelson 1105); Inyan Kara Creek (T. A. Williams 2581); Crazy Womans Creek (T. A. Williams 2734). *Idaho*: Beaver Canyon (P. A. Rydberg 2344); Snake River (G. W. Letterman 90). *Yellowstone National Park*: Yellowstone Lake (A. Nelson 6628); Cash Creek (F. Tweedy 588). *Montana*: Spanish Creek Basin (T. A. Williams 2050); Northern Pacific R. R. (F. Lamson-Scribner); Lima (C. L. Shear 566; P. A. Rydberg 2315); Barker (P. A. Rydberg 3361); Castle (P. A. Rydberg 3253); Spanish Creek (P. A. Rydberg 3047). *South Dakota*: Rochford (P. A. Rydberg 1165). *North Dakota*: Bottineau (M. A. Brannon 79, 87, 92); Devils Lake (C. A. Geyer). *Manitoba*: Brandon (J. Macoun 13049); Rapid City (J. Macoun 13047). *Assiniboia*: Moose Jaw (J. Macoun 13043). *Saskatchewan*: (J. Macoun 77). *Alberta*: Milk Rim Ridge (J. Macoun 13037). This is the western expression of *B. kalmii*, and but for its geographical distribution, I should be inclined to regard it as a variety of that species into which it passes by way of Minnesota and Canada. It is usually distinguished from that species by its smooth, narrower leaves, and narrower, fewer-nerved, empty glumes. It is also connected by intermediate forms with *B. richardsoni*.

19 α. BROMUS PORTERI LANATIPES n. var.

In its typical form this is a robust plant whose most striking character is its densely soft-downy or woolly sheaths. The leaves are scabrous both sides and larger than in the species; the panicle mostly larger and denser with spikelets somewhat larger and the empty glumes merely scabrous on the nerves or quite smooth.

Type No. 739, collected by C. L. Shear, Idaho Springs, Colo.

General distribution: Southern California, Arizona, New Mexico, and Colorado.

SPECIMENS EXAMINED.—*California*: San Bernardino Mountains (S. P. Parish 253 & 2533a; S. B. & W. F. Parish 1535). These specimens not typical. *Arizona*: Dos Cabezas (J. D. Emersley); no locality (J. D. Emersley 8). *Colorado*: Boulder (G. W. Letterman 9); Idaho Springs (C. L. Shear 739; P. A. Rydberg 2490 & 2496); La Veta (C. L. Shear 811); Golden (G. W. Letterman 8); M. E. Jones 269); Trinidad (S. M. Tracy 124); Walsenburg (C. L. Shear 799).

This variety passes by various forms into the species. It also closely approaches *B. richardsoni*. The specimens cited from southern California have the sheaths less densely pubescent and approach *B. laxipes*.

19 β. BROMUS PORTERI HAVARDII nom. nov. *Bromus ciliatus* minor Munro, Dewey in Contr. U. S. Nat. Herb. 2: 548. 1894. Not *B. macranthus* minor Desv. 1853.

An erect, rather densely tufted plant, *glaucous and nearly smooth throughout*. Spikelets 15–18 mm. long; empty glumes unequal, *the lower 1-nerved 3–5 mm. long, the upper 3-nerved, 5–6 mm. long, flowering glume 7–8 mm. long*. Awn about 2 mm. long. This differs from the species in its glaucous more rigid leaves and smaller, somewhat more coarsely pubescent spikelets.

Type No. 20, collected by V. Havard, slopes of Chisas Mountain, Vieja Mountain, west Texas.

19 γ. BROMUS PORTERI FRONDOSUS n. var. (Fig. 20.)

A slender, weak, erect or ascending, somewhat tufted perennial, about 6–9 dm. high. Culm smooth, leafy. Sheaths smooth; ligule about 1 mm. long, truncate and irregularly dentate; *blades linear, weak, mostly 1–2 dm. long and 3–4 mm. wide, smooth throughout*. Panicle 1–2 dm. long, *very weak and drooping*; lower branches 2–4. Spikelets 2–2.5 cm. long, 7–11-flowered, oblong-lanceolate in flower, pale green and drooping; empty glumes *3-nerved, smooth, mostly acute,*

lower 5-8 mm. long, upper 6-7 mm. long, slightly broader; flowering glume subacute, 9-11 mm. long, softly pubescent over the back, 5-7-nerved, only 3 nerves very distinct, hyaline at the apex and emarginate, awn 2-3 mm. long; palea puberulent, nearly equaling its glume.

Type collected by J. G. Smith at Mangos, New Mexico, August 19, 1897.

SPECIMENS EXAMINED.—*New Mexico*: Mangos Canyon (J. G. Smith, Sept. 21, 1896); (O. Metcalfe, Sept. 20, 1897); Saddle Rock Canyon, Grant County, alt. 2,170 meters (J. G. Smith, Sept. 24, 1896).

Base of San Luis Mountains, International Boundary Collection (E. A. Mearns 2146).



FIG. 20.—*Bromus porteri frondosus*: a, empty glumes and two flowerets; b, dorsal view of a flowering glume.

lateral nerves, 6-7 mm. long, the upper broader, 3-5-nerved, mostly inequilateral at the apex and mucronate, 8-9 mm. long; flowering glume inconspicuously 7-nerved, broadly lanceolate, subobtuse, emarginate, 11-12 mm. long, pubescence somewhat denser and somewhat pilose on the lower margins and base, with a straight awn 4-6 mm. long; palea about equaling its glume.

Type No. 1703, collected by Scribner & Shear, in moist thickets near the seashore south of Seaside, Oregon.

General distribution: Along the coast from Oregon to Alaska.

This plant, whose favorite habitat seems to be among cliffs in canyons, may prove on further field study to be found worthy of specific rank. The herbarium specimens differ from the species in their very weak, leafy culms, rather narrower and less densely flowered spikelets with the empty glumes smooth.

20. *BROMUS PACIFICUS* n. sp. (Fig. 21.)

A stout, nearly erect perennial 10-15 dm. high. Culm leafy, pubescent at the nodes. Sheaths mostly sparsely retrorsely-pilose; ligule 3-4 mm. long, rounded above, somewhat lacerate dentate; blades broadly linear-lanceolate, 2-3.5 dm. long, 8-11 mm. broad, sparsely coarse-pilose above, scabrous beneath. Panicle rather large, dense, drooping; lower branches secund, 3-5. Spikelets 2-2.5 cm. long, 5-6 mm. wide, 7-11-flowered, coarsely pubescent throughout; empty glumes acute, the lower rather narrow, 1-nerved or rarely with two short faint

SPECIMENS EXAMINED.—*Oregon*: Seaside (Scribner & Shear 1711). *Vancouver Island*: (J. Macoun 93). *Alaska*: Prince of Wales Island (W. G. Wright 1595).

This species appears nearly related to *B. richardsoni*, but is much more robust, with rather denser panicle and coarser pubescence which covers the empty glumes as well as the flowering glumes. It appears to be the same as the *B. purgans* of Grisebach in Ledebour's "Flora Rossica."

21. BROMUS PURGANS L. Sp. Pl. 1:76. 1753. *Bromus ciliatus purgans* A. Gray, Man. Bot. 600. 1848. (Fig. 22.)

Bromus steudelii Frank in Steud. Nom. Bot. ed. 2. 1:229. 1840. nom. nud.

A rather stout perennial, 7–14 dm.

high. Culm erect, smooth or pubescent at the nodes. Sheaths usually coarsely retrorse-pilose; ligule 1–2 mm. long, rather firm, truncate; blades broadly linear-lanceolate, 15–30 cm. long, 5–15 mm. broad, somewhat auricled at the base, short-pilose on the nerves above or smooth, scabrous or smooth beneath. Panicle large, lax, nodding, mostly 15–25 cm. long; lower branches 2–4, long, slender, flexuous. Spikelets mostly 7–11 flowered (Linnaeus says "8 ad 14"), 2–2.5 cm. long, terete-acuminate at first, becoming oblong-lanceolate in outline and somewhat flattened; empty glumes narrow, acuminate, sparsely covered with short pubescence; the lower 1-nerved, 5–7 mm. long; the upper broader, 3-nerved, 7–9 mm. long; flowering glume lanceolate, acute, or sub-acute; 5-nerved, or sometimes with two more faint nerves when mature, 10–12 mm. long, with rather short sparse pubescence over the back, emarginate or shortly bidentate at the apex; awn straight, slender, 4–6 mm. long; palea nearly equaling its glume, rachilla slender, pubescent, 2–3 mm. long.



FIG. 21.—*Bromus pacificus*: a, empty glumes with two florets; b, dorsal view of the flowering glume.

Type collected by Kalm in Canada.

General distribution; New England to Florida, west to northeastern Wyoming, and south to Texas.

SPECIMENS EXAMINED.—*Connecticut*: Bridgeport (E. H. Fames). *New York*: Ithaca (F. V. Coville); Little Falls (G. R. Vasey). *New Jersey*: Stockholm (Wm. M. Vansickle). *Pennsylvania*: Huntingdon County (T. C. Porter); Easton (T. C. Porter); Philadelphia (C. E. Smith 39; F. Lamson-Scribner). *Delaware*: Wilmington (A. Commons 79, 130). *Maryland*: Baltimore (K. A. Taylor 11802). *District of Columbia*: Washington (F. Blanchard); Chain Bridge (Conant & Vasey).

North Carolina: Biltmore (Biltmore Herbarium 128a). *Georgia*: Rome (Dr. Chapman). *Tennessee*: Knoxville (A. Ruth 30); Franklin County (H. Eggert 28). *Kentucky*: Big Black Mountain (T. H. Kearney jr. 276). *Ohio*: Cincinnati (C. G. Lloyd 3515). *Illinois*: Chicago (H. N. Babcock); Mount Carmel (J. Schrenck). *Michigan*: Rochester (O. A. Farwell 563). *Iowa*: Lebanon (C. R. Ball and A. F. Sample 26); Ames (C. R. Ball 123); Fayette County (B. Fink 290, 629); Decatur County (T. J. and M. F. L. Fitzpatrick 12). *Minnesota*: Duluth (G. Vasey). *Wyoming*: Sundance (T. A. Williams 2596). *Nebraska*: Julian (C. L. Elmore 135); near Mullen (P. A. Rydberg 1775). *Missouri*: Independence (B. F. Bush 812);

Courtney (B. F. Bush 594). St. Louis (H. Eggert). *Arkansas*: (F. L. Harvey 9). *Indian Territory*: Between Fort Cobb and Fort Arbuckle (Dr. E. Palmer 407).

This species has been the cause of much confusion, and has been very differently interpreted by different authors. Some, including Vahl, Hooker fil., Grisebach, and Fournier, apparently accepting Linnæus's doubtful reference to Feuillée's plate of *B. catharticus* as the true *B. purgans*, have referred various forms of the subgenus *Ceratochloa* to it. Others, as Torrey and Hooker, have referred *B. kalmii* and related forms to it, while Dr. Gray seems to have been the first to apply the name to the plant described by Linnæus, whose description is so complete as to leave little doubt as to the plant he had in hand. The species shows occasional connecting forms with *B. ciliatus*. It is also very closely related to *B. ramosus* of Europe. In the West and North it appears to merge into *B. richardsoni*. It is distinguished from *B. kalmii*, another near relative, by its longer and narrower empty



FIG. 22.—*Bromus purgans*: a, lower portion of a spikelet; b, dorsal view of a flowering glume.

glumes and the shorter and sparser pubescence of the flowering glumes, as well as by its larger panicle and broader leaves.

A specimen in the Columbian University herbarium from Meisner's Herbarium, collected by Frank near Cincinnati, and labeled "*Bromus steudelii* Frank n. sp.?" is merely a form of this species with a somewhat smaller panicle than usual.

21α. *BROMUS PURGANS LATIGLUMIS* (Scribn.) n. comb. *Bromus ciliatus latiglumis* Scribn. in herb. *Bromus allissimus* Pursh, Fl. Am. Sept. 2: 728. 1814. Not Gilib. 1792. *Bromus ciliatus porteri* Rydb. Contr. Nat. Herb. 3: 193. 1895.

Culms very leafy, sheaths usually much overlapping and furnished with a rather conspicuous pilose-pubescent ring at the summit; blades rather broadly auricled at the base. Spikelets and flowering glumes rather broader than in the species. The pubescence at the base of the flowering glume is slightly denser than elsewhere. In other respects like the species.

Type No. 222, collected by L. H. Pammel, Dakota City, Iowa.

General distribution about the same as for the species, but apparently reaching its greatest development in numbers west of the Mississippi.

SPECIMENS EXAMINED.—*Connecticut*: South Glastonbury (Frances Wilson 124). *New York*: Oxford (F. V. Coville). *Pennsylvania*: Easton (T. C. Porter). *Minnesota*: Forest Mills (C. A. Ballard). *South Dakota*: Redfield (David Griffiths 74); Big Stone (Mr. & Mrs. T. A. Williams; James River, Brown County (David Griffiths 784); Canning (T. A. Williams). *Montana*: Smith River (F. Lamson-Scribner 77). *Nebraska*: near Thedford (P. A. Rydberg 1775—this number is the one on which Rydberg founded the new combination cited above. In character of spikelets and in the rather narrower leaves than usual it approaches *B. porteri*, but in other respects it is this variety; Holt County (F. Clements 2824). *Iowa*: Forest City (B. Shimek 62); Ames (C. R. Ball 4); Jackson County (B. Shimek 34); Dakota City (L. H. Pammel 222). *Missouri*: (H. Eggert); Jefferson County (H. Eggert 606); Allenton (G. W. Letterman 14).

This form connects the species with *B. richardsoni* and *B. porteri*, the more numerous leaves, the overlapping sheaths, and larger panicle separating it from the latter. The overlapping sheaths and more equally distributed pubescence of the flowering glume distinguishes it from the former. The citation of *B. altissimus* Pursh as a synonym is based upon the examination of specimens in the herbarium of the Philadelphia Academy marked "Herb. Pursh." The specimens agree perfectly with Pursh's description and are apparently authentic.

21β. *BROMUS PURGANS*? *TEXENSIS* n. var.

A slender plant, somewhat geniculate at the base and 3–4 dm. high. Sheaths short pilose-pubescent; ligule 1–1.5 mm. long, lacinate; blades linear, pubescent throughout, about 6–10 cm. long. Panicle small, somewhat nodding, with only 3–5 spikelets in the specimen at hand. Spikelets terete at first, then lanceolate and somewhat laterally contracted; empty glumes acuminate, scabrous, the lower 1-nerved, 7 mm. long, the upper inequilateral and mucronate at the apex, 9–10 mm. long; flowering glume 7-nerved, 10 mm. long, sparsely and coarsely scabrous, very short dentate at the apex; awn straight, 6–7 mm. long; palea equaling its glume, keels finely serrate.

Type No. 230, collected by G. Jermy, Bexar County, Texas.

This is the only specimen of this form we have seen. More material is necessary to determine definitely its status and relationships. It may prove a good species.

21γ. *BROMUS PURGANS INCANUS* n. var.

This is very near *B. purgans latiglumis*, differing from it in having the sheaths densely soft pilose-pubescent. It also passes into *B. porteri lanatipes* in the southwest. It is generally separated from that by its broader leaves and narrower empty glumes, which are like the flowering glumes sparsely pubescent.

Type No. 3, collected by J. Wolf, Canton, Illinois.

General distribution apparently about the same as for the species.

SPECIMENS EXAMINED.—*Pennsylvania*: Easton (T. C. Porter). *District of Columbia*: High Island (F. L. Scribner). *Ohio*: Pittsfield (A. E. Ricksecker). *Iowa*: Fayette County (B. Fink, 414). *South Dakota*: Union County (E. J. Wallace). *Texas*: Chenates (G. C. Nealley), poor and not typical.

22. BROMUS ORCUTTIANUS Vas. Bot. Gaz. 10:223. 1885. (Fig. 23.)

A rather stout, erect, perennial 8-12 dm. high. Culm leafy below, mostly puberulent at and just below the nodes. Sheaths usually glabrous; ligule 1-2 mm. long, subtruncate; blades broadly linear-lanceolate, rather coarse, smooth throughout, 10-20 cm. long, 5-7 mm. broad. Panicle narrow-pyramidal, erect, or nearly so, 10-15 cm. long, 5-8 cm. broad at the base when spread, branches few, widely divaricate in fruit and rather rigid. Spikelets about 2-2.5 cm. long, 2-3 mm. broad, on short, stout pedicles, terete-acuminate, 5-9 flowered; florets at maturity rather distant on

a slender zigzag rachilla, separating and falling easily at maturity; empty glumes narrow, smooth or scabrous, the lower acute, 6-8 mm. long, 1-nerved, or sometimes with 2 short, faint lateral nerves, the upper broader, subobtus, 3-nerved, 8-10 mm. long; flowering glume 10-12 mm. long, narrow, obtuse, scabrous to scabrous-pubescent over the back, faintly 5-7-nerved, with a hyaline, slightly emarginate apex; awn rather stout, about 5-7 mm. long; palea nearly equaling its glume; rachilla slender, puberulent, joints about 4 mm. long.

Type in the Herbarium U. S. Department of Agriculture, collected by C. R. Orcutt in the mountains near San Diego, Cal., No. E.

General distribution: Southern California to Washington, chiefly on rather dry open mountain sides and in dry evergreen forests.

SPECIMENS EXAMINED.—California: Open woods, Truckee River (C. F.

Sonne 21); Southern California (Dr. E. Palmer 233); Mariposa (J. W. Congdon); Pioneer (Geo. Hansen 1835); Kaweah River Valley (Coville and Funston 1346); San Jacinto Mountains (H. M. Hall 7861); Forest Dale (J. B. Davy). Oregon: Ashland Butte (T. Howell 253); Gayhart Butte (Coville and Leiberg 277). Washington: Mount Adams (W. N. Suksdorf 120); Klickitat River near Mount Paddo (Mount Adams) (W. N. Suksdorf 172).



FIG. 23.—*Bromus orcuttianus*: a, empty glumes with a floret; b, dorsal view of a flowering glume.

22α. BROMUS ORCUTTIANUS GRANDIS n. var.

A stout, erect perennial 14–15 dm. high, very leafy below. Sheaths, leaves, and culm pubescent throughout. Panicle about 2 dm. long and nearly as broad at base at maturity when the branches are spread more or less horizontally. Spikelets pubescent throughout. Its distinguishing characters are its size and pubescence. In other respects the plant is like the species.

Type No. 472, collected by C. R. Orcutt at La Maite, San Diego, California. The only specimen seen.

23. BROMUS VULGARIS (Hook) n. comb. (Fig. 24.)

B. purgans vulgaris Hook. Fl.

Bor. Am. 2 : 252. 1840.

B. debilis Nutt. in Herb.

Acad. Nat. Sci. Phil. *B.*

ciliatus pauciflorus Vasey in

Beal Grass. N. A. 2 : 619.

1896. Not Schum. nor

Willd. *B. ciliatus ligulatus*

Vas. in Macoun Cat. Can.

Pl. 4 : 238. 1888. Nomen

nudum.

A slender, erect perennial 8 to 11 dm. high, with narrow, pale green, sparingly pilose leaves and few-flowered, nodding panicle, 8 to 12 cm. long. Culms somewhat pubescent, at least below the nodes, nodes bearded, the short hairs directed downward. Sheaths pilose, lower ones which are usually purplish, quite densely so, with spreading or reflexed hairs; ligule membranous or subhyaline, truncate, lacerate, 3–5 mm. long; blades 15–25 cm. long, 5–9 mm. wide, thinly pilose above, glabrous or sparsely pilose beneath, sparingly scabrous on the margins and on the nerves below. Spikelets about 22–28 mm. long, including awns, 3–4 mm. wide; pedicels somewhat enlarged just below the spikelet and pubescent; empty glumes somewhat sparsely covered with a short, coarse pubescence, lower glume narrow-lanceolate, very acute, 5–8 mm. long, 1-nerved; upper glume 3-nerved, much broader and longer than the first, obtuse or subacute and often bifid at the apex, the midnerve excurrent as a short awn, scabrous on the back, the nerves usually purplish; flowering glume about 8–10 mm. long, sparsely pubescent over the back, subciliate near the margins, 5-nerved, the 3 nerves much more prominent than the intermediate



FIG. 24.—*Bromus vulgaris*: a, showing empty glumes; b, partial ventral view of a floret showing the palea and a joint of the rachilla.

ones; apex entire or shortly 2-toothed; awns *slender*, 6–9 mm. long. Joints of the rachilla 2–3 mm. long, pubescent; palea nearly or quite equaling its glume, ciliate on the keels and scantily pubescent between them.

Type: Hooker l. c. refers several collections made by Richardson, Douglas, and Scouler to this species. Through the kindness of the director of the Kew Gardens we have received a spikelet from the specimens collected by Dr. Scouler on the Columbia which proves to be the same as the synonyms given.

General distribution: California north to Vancouver Island, east to Montana and the Blue Mountains of Oregon. The typical form seems to be most frequent in the Blue Mountains.

SPECIMENS EXAMINED.—*California*: Santa Cruz (M. E. Jones); Marin Co. (E. Palmer 2043); (C. L. Anderson 66); (H. Bolander 4753.) *Oregon*: (W. C. Cusick 1061, 2061); (T. Howell 80, 205); banks Santiam (M. Craig); Portland (T. Howell); McMinnville (C. L. Shear 1652); Lake Wallowa (C. L. Shear 1747); Blue Mountains (C. L. Shear 1690, 1667). *Washington*: Klickitat River (W. N. Suksdorf 177); West Klickitat Co. (W. N. Suksdorf 175); Upper Valley Nesqually (O. D. Allen 41); Blue Mountains (C. V. Piper 2564, 2563; Lake & Hull 2079); (Sandberg & Leiber 449); (L. F. Henderson 2145); Tacoma (A. B. Leckenby). *Idaho*: Latah Co. (C. V. Piper 1740); Moscow Mountains (L. F. Henderson); Lake Coeur d'Alene (Sandberg, Heller & McDougal 582); Farmington (Sandberg, Heller & McDougal 523); Nez Perces Co. (A. A. & E. G. Heller 3423). *Montana*: Bozeman (P. A. Rydberg 2227); Sour Dough Canyon (J. W. Blankinship). *British Columbia*: Deer Park, Lower Arrow Lake (J. Macoun 17).

This plant has most frequently been referred to *B. ciliatus* heretofore, but is easily separated from that species by its smaller panicle, longer awn, and long ligule, and also by the distribution of the pubescence on the flowering glume. It is quite variable in some respects and seems to pass through its various forms into *B. levipes*.

23α. *BROMUS VULGARIS EXIMIUS* n. var. *Bromus ciliatus glaberrimus* Suksdorf in herb. Not *B. glaberrimus* Koch, *Linnaea*, **21**: 420. 1848.

A more erect and robust plant than the type, leaves broader, in the type 1 cm. broad, leaves, sheaths, and culms glabrous as is also the flowering glume except on the margin and midnerve near the base where it is scantily pubescent.

Type No. 1791, collected by C. L. Shear on moist, open mountain side 4 miles above Wallowa Lake, Oregon.

General distribution: Oregon and Washington.

SPECIMENS EXAMINED.—*Oregon*: near Wallowa Lake (C. L. Shear 1787, 1799). *Washington*: Skamania Co. (W. N. Suksdorf 2335). This number was the type of Suksdorf's variety cited above. Yakima region (F. Tweedy, July, 1882).

23β. *BROMUS VULGARIS ROBUSTUS* n. var.

A tall leafy form sometimes reaching 15–18 dm. high; leaves and sheaths sparsely pilose-pubescent; the panicle larger than in the species and having the flowering glumes pubescent on the margin and keel at the base, as in *B. vulgaris eximius*, from which it differs chiefly in the pilose-pubescent leaves and sheaths and rather larger panicle.

Type No. 1710, collected by Scribner and Shear in moist thickets near the seashore, Seaside, Oregon.

General distribution: Oregon to Vancouver Island along the coast; also from Idaho.

Specimens examined.—*Oregon*: Seaside (Scribner & Shear 1707, 1710); McMinnville (C. L. Shear 1653). *Idaho*: Weisners Peak (Sandberg, Heller & McDougal 599). *Washington*: Base of Mount Adams (W. N. Suksdorf 176); near Montesano (A. A. & E. G. Heller 3999). *Vancouver Island*: (J. Macoun 176) not typical.

24. BROMUS LAEVIPES n. sp. (Fig. 25.)

A perennial, *spreading somewhat by rootstocks*, with an erect or somewhat geniculate culm about 7–10 cm. tall, puberulent just below the nodes. Sheaths *glabrous*; ligule 3–4 mm. long, truncate, entire or somewhat lacerate-dentate; blades linear-lanceolate, *glabrous or slightly scabrous*, about 15–20 cm. long and 4–7 mm. broad. Panicle broad, lax, drooping, about 15–20 cm. long, lower branches 2–4. Spikelets drooping, narrow, terete, acuminate at first, 5–9-flowered, 2.5–3.5 cm. long; empty glumes smooth, the lower acute, 3-nerved, 6–8 mm. long; the upper 5-nerved, broader, 9–11 mm. long; flowering glume obtuse, 7-nerved, 12–15 mm. long, *densely ciliate-pubescent on the margin nearly to the apex and also on the back at the base*; apex hyaline, emarginate, usually brownish yellow; awn straight, 3–4 or rarely 5 mm. long; palea about 2 mm. shorter than its glume.

Type No. 178, collected by W. N. Suksdorf on the Columbia River, West Klickitat Co., Washington.

General distribution: Mostly in the Coast Range and Cascade Mountains, California, north to Washington.

SPECIMENS EXAMINED.—*California*: Hood's Peak (Bioletti 112); Black Mt. (C. Rutter 1); San Jose (Miss Bush); Borax Lake (J. Torrey 574—a poor specimen, somewhat doubtful); Pitt River, Shasta Co. (H. E. Brown 279); Head of Russian River (J. W. Blankinship 41); Agricultural Station, Amador Co. (Geo. Hansen 610); no locality (G. R. Vasey). *Oregon*: Grant's Pass (T. Howell 250).

This species is closely related to *B. vulgaris*, *B. orcuttianus* and *B. richardsoni pallidus*.

From the first it is distinguished by its smooth leaves and sheaths and much stouter habit, as well as broader spikelets and denser pubescence of the flowering glume. From the second it differs in the larger drooping panicle and different distribution of pubescence on the flowering glume. It appears closest to the third, *B. richardsoni pallidus*, into which it probably intergrades. It differs in its typical form from that in its much more robust habit and more pubescent flowering glumes; also in its geniculate base and the production of a rootstock.



FIG. 25.—*Bromus laevipes*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

B. Panicle narrow, erect or nearly so, spikelets usually larger than in A, and the pubescence on the flowering not evenly distributed.

25. BROMUS SUKSDORFII Vas. Bot. Gaz. 10:223. 1885. (Fig. 26.)

An erect, coarse, tufted, leafy perennial, 6-10 dm. high. Culm smooth or puberulent just below the nodes. Sheaths smooth; ligule about 1 mm. long, *subcoriaceous*, truncate, dentate; blades mostly 5-6, broadly linear-lanceolate, rather abruptly acuminate, 1-2 dm. long, 8-11 mm. broad, firm and smooth. Panicle narrow, erect, rather dense, mostly 8-13 cm. long, lower branches 2-5, longest 2-4 cm. long,

erect or ascending. Spikelets 5-9-flowered, 2-3 cm. long, terete at first, becoming somewhat lanceolate at flowering; pedicels shorter than the spikelets; empty glumes glabrous or scabrous on the nerves, the lower lanceolate-acuminate, 1-nerved or sometimes with a short faint lateral nerve on each side, 8-10 mm. long, the upper broader, subacute, 3-nerved, 10-12 mm. long; flowering glume oblong-lanceolate, subacute, 12-14 mm. long with 3 prominent nerves and frequently 2 other very faint ones on each side, *appressed-pubescent* from the lateral nerves to the margins and on the midnerve about halfway up the back, other portions smooth or scabrous, emarginate at the apex; awn 2-4 mm. long; *palea* little more than three-fourths the length of its glume.

Type No. 74, collected by W. N. Suksdorf "in loose soil on dry mountain sides," Mt. Adams, Washington.

General distribution: Mountains of Oregon and Washington.

SPECIMENS EXAMINED.—Oregon: Crater Lake (Coville & Leiberg 423); Powder River Mt. (C. V. Piper 2523); Ashland Butte (T. Howell 249); (W. C. Cusick 1075).

This species is closely related to *B. pumpellianus*, but differs in lacking the creeping rootstock and in having a denser panicle, longer flowering glume with shorter pubescence and shorter palea. The spikelets are also narrower in flower and greenish straw color.

26. BROMUS ERECTUS Huds. Fl. Angl. 39. 1762. *Bromus macounii* Vas. Bul. Torr. Bot. Club, 15: 48. 1888. (Fig. 27.)

A caespitose perennial with narrow leaves and an erect subsimple panicle. Culms about 6-9 dm. high, erect, glabrous. Sheaths sparingly pilose or nearly glabrous; ligule about 1.5 mm. long; blades somewhat rigid, narrowly linear, sparingly



FIG. 26.—*Bromus suksdorfii*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

pubescent or somewhat ciliate, *the radical conduplicate*, those of the stem somewhat broader, about 1-2 dm. long. Panicle about 1-2 dm. long, narrow, pyramidal, branches erect or ascending. Spikelets fusiform-cylindric before flowering, afterwards oblong-lanceolate and somewhat laterally compressed, 5-10-flowered, sometimes purplish; empty glumes acuminate, usually scabrous on the nerves; the lower 1-nerved, 6-8 mm. long; the upper 3-nerved, 8-10 mm. long; flowering glume 10-12 mm. long, 5-nerved, oblong-lanceolate, acuminate, shortly bidentate with narrow scarious margins and apex *evenly scabrous-pubescent on the back*; awn straight, slender, 5-6 mm. long. An adventive species from Europe.

SPECIMENS EXAMINED—*Ontario*: Kingston (J. Fowler in 1895). *Vermont*: (C. G. Pringle in 1877).

This species is reported in Britton & Brown. Ill. Fl., as being introduced in waste places about New York. The specimen collected by J. Macoun, No. 76, Vancouver Island, and named *B. macounii* by Vasey, seems to us a mere form of this species, differing only in its somewhat narrower and more rigid panicle. This species is nearly related to *B. pumpellianus*.

27. BROMUS INERMIS Leyss.
Fl. Hal. 16. 1761. *Schedonorus inermis* Beauv. Agrost. 99. 1812. (Fig. 28.)

An erect, smooth perennial with a creeping rootstock and erect, *broadly pyramidal or subcorymbose panicle*. Culm rather stout, smooth, about 5-9 dm. high. Sheaths smooth; ligule 1.5-2 mm. long, subtruncate, somewhat lacerate; blades linear-lanceolate, flat, smooth, or minutely scabrous, about 1.5-2.5 dm. long and about 5-10 mm. broad. Panicle rather dense, somewhat diffuse, 10-20 cm. long. Spikelets erect or somewhat drooping, narrow, *terete*, about 2-2.5 cm. long and 4-5 mm. wide after flowering; empty glumes smooth, the lower narrow, acute, 1-nerved, 4-5 mm. long, the upper subacuminate, 3-nerved, about 6-8 mm. long; flowering glume obtuse, emarginate, 5-nerved, about 9-12 mm. long, typically glabrous, but sometimes ciliate-pubescent on the lower half of the margins and the midrib, muticous or with an awn sometimes reaching 3 mm. long; palea equaling the glume.

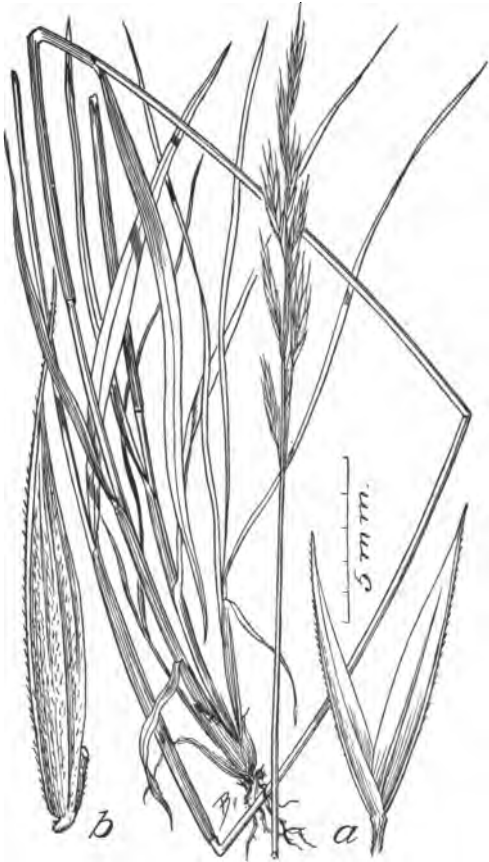


FIG. 27.—*Bromus erectus*: a, empty glumes; b, lateral view of the flowering glume with a joint of the rachilla.

General distribution: This species, which has been introduced from Europe under the name of smooth or Hungarian brome-grass, is being grown in many places throughout the semiarid regions of the West, where it is to be met with as an escape from cultivation.

It is very closely related to *Bromus pumpeillianus*, but has narrower panicles and spikelets, also smoother glumes.

28. BROMUS PUMPELLIANUS Scribn. Bul. Torr. Bot. Club **15**: 9. Jan. 1888.

Bromus purgans purpurascens Hook. Fl. Bor. Am. **2**: 252. 1840. Not *B. purpurascens* Del. 1813. *Bromus macounii* Vas. p. p. Bul. Torr. Bot. Club, **15**: 48. 1888. (Fig. 29.)



FIG. 28.—*Bromus inermis*: a, a spikelet; c, ventral view of a floret, showing the palea and a joint of the rachilla.

A stout, erect perennial, 6–12 dm. high, with creeping rootstocks. Culms smooth or pubescent at the nodes. Sheaths smooth or sparsely pilose-pubescent; ligule firm, truncate, rarely exceeding 1 mm. long; blades broadly linear-lanceolate, 5–10 mm. wide, 1–2 mm. long, mostly smooth below and scabrous or somewhat pubescent above, somewhat auriculate at base, point frequently involute and rigid when dry. Panicle rather narrow, erect, 10–20 cm. long, mostly 10–15 cm.; branches short, erect, or ascending. Spikelets mostly 7–11-flowered, 2–3 cm. long, terete-acuminate at first, somewhat laterally compressed at and after flowering, 5–7 mm. wide; empty glumes smooth and shining, the lower 1-nerved, or rarely with two faint lateral nerves, acuminate, 6–8 mm. long, the upper broader, 7–10 mm. long, 3-nerved; flowering glume broad, ovoid-lanceolate, subacute, 5–7-nerved, 10–12 mm. long, densely and

coarsely ciliate-pubescent on the margin, nearly or quite to the apex and across the back at the base; apex slightly emarginate; awn mostly 2–3 mm. long, rarely reaching 4–5 mm. long, or occasionally nearly or quite mucous; palea nearly equaling its glume; rachilla slender, pilose-pubescent.

Type No. 418, collected by F. Lamson-Scribner in the Belt Mountains, Montana.

General distribution: Colorado to South Dakota north to western Alaska.

SPECIMENS EXAMINED.—*Colorado*: Dillon (C. L. Shear 1068½); Penns Gulch (G. W. Letterman 93); El Paso County (G. W. Letterman 38); Pikes Peak (C. L. Shear 771); Villa Grove (C. L. Shear 885); Breckenridge (C. L. Shear 1082); Veta Pass

(G. Vasey); no locality (John Wolfe 1158); Grizzly Creek (C. F. Baker 14); Como Park (C. L. Shear 1092). *Wyoming*: Sundance (T. A. Williams 2602, D. Griffiths 423); Bear Lodge (T. A. Williams 2629); Inyan Kara Mountain (D. Griffiths 634); Big Horn Mountains (W. H. Forwood). *South Dakota*: Custer (David Griffiths 700); Elk Creek, Black Hills (P. A. Rydberg 1167); Sylvan Lake (D. Griffiths 719, 708). *Montana*: Columbia Falls (R. S. Williams); Gallatin River Canyon (J. W. Blankinship); Black Hawk (P. A. Rydberg 3271); Dry Fork Belt Creek (P. A. Rydberg 3356); Barker (P. A. Rydberg 3362, 3383). *British America*: Rocky Mountains (J. Macoun 14); Fort Ellice (J. Macoun 104). *Alberta*: Near Banff (J. Macoun 23, 30); Benton Trail, Milk River (J. Macoun 13051); Devils Head Lake (J. Macoun 25, 27); Elbow River (J. Macoun 18638); Crow Nest Pass (J. Macoun 18639). *Saskatchewan*: Prince Albert (J. Macoun 13050); Saskatchewan Plains (J. Macoun 78). *British Columbia*: Kicking Horse Lake (J. Macoun 15). *Alaska*: Fort Yukon (O. S. Bates).

This plant is closely related to *B. erectus* and also to *B. inermis*, both of which are only found in this country as introduced or adventive species. Our species, which is rather frequent in the Rocky Mountains from Colorado north, reaches Alaska and probably connects with *B. inermis* in eastern Siberia. Our plants can usually be distinguished from *B. erectus* by their broader spikelets, longer awns, and the coarse ciliate-pubescent margins and bases of the flowering glumes. The leaves of the sterile shoots or innovations of *B. erectus* are narrow and involute and the plant caespitose. In the case of *B. inermis* the relationship is closer and the separation more difficult. Generally our species has a narrower, denser, more rigidly erect panicle with shorter branches and broader spikelets. The flowering glumes are more coarsely and densely ciliate-pubescent and very rarely muticous. The difficulties of separating these species are likely to be greatly increased in the future by the rapid distribution of the cultivated forms of *B. inermis* in the region occupied by *B. pumpellianus* and also by the probability of hybridization of the two plants. Judging from the description and a single spikelet from the type of Hooker's *B. purgans purpurascens*, collected by Dr. Richardson in the region of Bear Lake, British America, it is the same as our plant.



FIG. 29. *Bromus pumpellianus*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

28α. BROMUS PUMPELLIANUS TWEEDYI Scribn. in Beal, Grass. N. A. 2: 622. 1896.

This differs from the species in having the leaves and sheaths usually pilose-pubescent throughout and the flowering glumes with coarser, denser, hirsute-pubescence. In other respects like the species.

Type No. 587, collected by Frank Tweedy, Slough Creek, Yellowstone Park.

General distribution apparently the same as for the species.

SPECIMENS EXAMINED.—*Colorado*: (H. N. Patterson 29); (M. E. Jones.) *Wyoming*: Sundance (D. Griffiths 435, 884); Meeteetse Creek (T. A. Williams 2917); Welcome (T. A. Williams 2673, 2682); Bear Lodge (T. A. Williams 2655). *Montana*: Lima (P. A. Rydberg 2309, C. L. Shear 568). *Alaska*: Yukon River (Dawson 92).



FIG. 30. *Bromus unioloides*: a, empty glumes; b, lateral view of a flowering glume.

28β. BROMUS PUMPELLIANUS MELICOIDES n. var.

This is a form having the sheaths retrorsely pilose-pubescent, especially on the lower half toward the nodes. The pubescence on the margins and of the flowering glume is rather short and scanty, and the awn is entirely wanting or sometimes 1 mm. long.

Type collected by Dr. L. H. Pammel, Beaver Creek Camp, Colorado, July 8, 1896, altitude about 3400 meters. This plant is rather intermediate between *B. pumpellianus* and *B. inermis*, but is apparently an endemic form and belongs rather with the former than the latter. The obtuse glumes, with thin, purple margins, give the plant a strong resemblance to *Melica*, whence the name.

V. CERATOCHLOA (Beauv.) Benth. & Hook.

Spikelet large, strongly compressed, and more or less keeled.

- 29. BROMUS UNIOLOIDES** (Willd.) H. B. K. *Festuca unioloides* Willd. Hort. Berol. 1: 3. pl. 3. 1806. *Bromus unioloides* H. B. K. (?) Nov. Gen. et Sp. Pl. 1: 151. 1815. *Bromus cartharticus* Vahl. (?) Symb. Bot. 2: 22. 1791. *Ceratochloa pendula* Schrad. Linnæa, 6: Litt. 72. 1831. *Ceratochloa schraderi* Kunth, Enum. Pl. 1: 416. 1833. *Ceratochloa brevistarata* Hook. Fl. Bor. Am. 2: 253. 1840.

Bromus willdenowii Kunth, Rev. Gram. 1:134. 1835. *Ceratochloa submutica* Steud. (?) Syn. Pl. Gram. 321. 1854. (Fig. 30.)

A rather stout annual, with erect or suberect panicle and strongly compressed oblong-lanceolate spikelets. Culms glabrous, about 5-10 dm. high. Sheaths usually pilose-pubescent, sometimes smooth, typically with a tuft of hairs at the base of the ligule; ligule about 3-4 mm. long, somewhat lacinate on the margin; blades linear, scabrous on both sides or sparingly pilose-pubescent. Panicle usually elongated and narrow pyramidal, 1.5-3.5 dm. long; lower branches 2-4, short in small forms, to rather long, spreading, or somewhat drooping in the larger ones. Spikelets 2-3.5 cm. long, 5-9 mm. broad, about 7-11-flowered; empty glumes broad, subacute, smooth or slightly scabrous, the lower usually 5-nerved, 7-10 mm. long, the upper usually 7-nerved, 10-13 mm. long; flowering glumes broadly lanceolate, acute, subcoriaceous, subglabrous to coarsely scabrous, slightly bidentate at the apex, about 13-16 mm. long, usually with a short stout awn, rarely exceeding 2 mm. long; palea between one-half and three-fourths the length of its glume.

General distribution: Alabama to California and southward. Perhaps introduced throughout most of our range. Occasionally met with in other Southern States.

Type grown at Berlin from seed sent from Carolina.

SPECIMENS EXAMINED.—*Alabama*: Montgomery (C. Mohr in 1868); Auburn (Earle & Baker 1502). *Louisiana*: Calhoun (C. R. Ball 76). *Texas*: San Antonio (A. W. Barr 1873); Riddleville (W. S. Ruckman in 1885). *New Mexico*: (A. Fendler 918—an immature plant approaching *B. polyanthus paniculatus*). *Arizona*: Pipe Spring (M. E. Jones 5272i); Tucson (J. W. Toumey 28). *California*: Kern County (A. B. Leckenby in 1896).

Bromus catharticus Vahl, l. c., judging from the original description, is but a mere form of this species, and were it not for the reference to Feuillée's plate (Jour. Obs. Phys., etc., de l'Amérique Merid. & Ind. Occ. 1) as representing the plant, we should not hesitate about adopting the name; but after examining a tracing of the plate kindly furnished by Dr. Robinson, we are inclined to think that there is a mistake, either in our interpretation of Vahl's description, or in his reference to Feuillée's plate, as that does not represent our plant. Only an examination of Vahl's type will settle the question conclusively. *Bromus submuticus* Steud l. c., collected at St. Louis, judging from the original description, belongs here. We have been unable thus far to locate the type specimen, so the matter still remains in some doubt.



FIG. 31.—*Bromus unioloides henkeanus*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

An examination of a spikelet from the type of *Ceratochloa breviaristata* Hook. proves conclusively that this is a mere short-awned form of *B. unioloides*. It is possible that the locality cited, "on the dry elevated ground of Lewis and Clarkes River and near the sources of the Columbia," may be the result of a confusion of labels. The plant, if found there, must almost certainly have been an adventitious one, which seems to us scarcely probable at that time—1826.

This species has been in cultivation so long that its endemic distribution is difficult or impossible to determine.

29α. BROMUS UNIOLOIDES HÆNKEANUS (Presl.) n. comb. *Ceratochloa hænkeana* C. B. Presl in J. S. Presl, Reliq. Hænk. 1: 285. 1828. (Fig. 31.)

An annual or biennial plant differing from the species in its smaller size, being about 1.5–5 dm. high, and narrow, erect, subracemose panicle 5–10 cm. long, with somewhat smaller spikelets. The leaves are narrow, linear, pilose, pubescent, both sides and sheaths retrorsely pilose. Type collected "in Cordilleris chilensibus, inque montanis Peruviae." General distribution: Florida to southern California.

PECIMENS EXAMINED.—*Florida*: Madison (R. Combs 247—a form with somewhat pubescent glumes). *Alabama*: Mobile (T. H. Kearney 16). *Texas*: Bexar County (G. Jermy 229); Hempstead (E. Hall 792); (J. Reverchon 119); Dallas (J. Reverchon 1105); Fort Clark (E. A. Mearns 1273); Corpus Christi (A. A. Heller 1497). *California*: Mentone (J. B. Leiberg 3296). Our specimens are like specimens from the type collection in the Bernhardt herbarium at the St. Louis Botanical Gardens (cf. Rept. Mo. Bot. Gard. 10: pl. 54. f. l. 1898) except that the sheaths are more pilose.



FIG. 32.—*Bromus subvelutinus*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

30. BROMUS SUBVELUTINUS n. sp. (Fig. 32.)

An erect, tufted perennial. Culm somewhat puberulent above, about 2.5–5 dm. high, *densely clothed at the base with the old sheaths*. Sheaths *canescent*; ligule about 1 mm. long, truncate, lacinate; blades *narrow, linear, rather rigid, becoming involute, canescent and also pilose with spreading hairs*, those of the culm 4–10 cm. long, those of the innovations longer. Panicle about 5–10 cm. long, narrow, erect, simple, sometimes bearing but a single spikelet, or the lower branches in pairs and about 1–3 cm. long. Spikelets 5–7 flowered, 2–3 cm. long, laterally compressed, becom-

ing rather turgid at maturity; empty glumes subobtusate, puberulent, the lower 3-5-nerved, 8-10 mm. long, the upper 7-nerved, 10-12 mm. long; flowering glume *appressed-puberulent*, indistinctly 7-nerved, 12-15 mm. long, with two short, rather obtuse, hyaline teeth and a *stout awn* 3-4 mm. long; palea short pectinate-ciliate on the keels, about 3 mm. shorter than its glume.

Type No. 249, S. M. Tracy, collected at Reno, Nevada, in 1887.

Distribution: Nevada and California.

SPECIMENS EXAMINED.—Nevada: l. c. California: Grassy mountain slope, Fort Tejon (S. B. Parish No. 1995).

This plant is most closely related to *B. marginatus* from which it is distinguished chiefly by the narrow, rigid, involute leaves, canescent leaves and sheaths, and somewhat caespitose habit. It seems to be peculiar to arid regions.

31. *BROMUS MARGINATUS*

Nees in Steud. Syn. Pl. Gram. 322. 1854. *Bromus breviaristatus* Buckl. and most auct. amer. Not *Ceratochloa breviaristata* Hook. *Bromus pauciflorus* Nutt. in Herb. Acad. Nat. Sci. Phil. (Fig. 33.)

An erect, tufted, rather stout, short-lived perennial. Culm 6-12 dm. high, mostly puberulent or pubescent. Sheaths *pilose-pubescent*; ligule 3-3.5 mm. long, subrotund, lacinate; blades broad, linear-lanceolate, *somewhat sparsely pilose-pubescent throughout*, rather rough and coarse, 1.5-2.5 dm. long, 6-12 mm. wide. Panicle erect, rather narrow, mostly 1-2 dm. long; *lower branches 2-4, erect, or somewhat spreading in flower, unequal, lowest rarely more than 7 cm. long and bearing 2 spikelets.* Spikelets 2.5-4 cm. long, 5-7 mm. wide, oblong-ovoid to oblong-lanceolate, laterally compressed, somewhat turgid at maturity, mostly 7-9-flowered, erect or ascending, the uppermost subsessile; empty glumes, rather broad, *scabrous to scabrous-pubescent*; the lower subacute, 3-5-nerved, mostly 7-9 mm. long; the upper broader, obtuse, 9-11 mm. long, 5-7-nerved, the lateral nerves broad; flowering glume, *subcoriaceous, coarsely pubescent*, ovate-lanceolate, acute, 11-14 mm. long, mostly 7-nerved, with two very short hyaline, *subacute* teeth at the apex and a rather stout straight awn 4-7 mm. long; palea ciliate-pectinate on the keels, almost or quite equalling its glume.



FIG. 33.—*Bromus marginatus*: a, empty glumes with three florets; b, dorsal view of a flowering glume.

Type collected by Douglas "on the Columbia River, St. Louis." The reference to St. Louis is evidently either an error or else refers to some locality on the Columbia not at present recognized in our atlases.

General distribution: Arizona and Colorado to Alberta and west to the Pacific.

SPECIMENS EXAMINED.—*Arizona*: (Dr. E. Palmer in 1869; 535 in 1876); Grand Canyon, (D. T. McDougal 181); Tucson (J. W. Toumey 752½). *Colorado*: (C. S. Crandall 523). *Wyoming*: Sundance (T. A. Williams 2611, 2612, and Griffiths 434, 911); Meeteetse Creek (T. A. Williams 2904); Bear Lodge (Williams 2655a); Little Laramie River (Williams 2322, 2230, and Aven Nelson 3333); Powder River (T. A. Williams 2799); Spring Creek (T. A. Williams 2813½, J. N. Rose 698); Sherman (G. W. Letterman 81); Parkman (Aven Nelson 2457); Sheridan (L. H. Pammel 1897); Hewlett (D. Griffiths 932); Beulah (Griffiths 970); Little Missouri Buttes (D. Griffiths 585); Medicine Bow River (A. Nelson 4073). *Yellowstone National Park*: Soda Butte (F. Tweedy 586). *Montana*: Bozeman (C. L. Shear 449, P. A. Rydberg 3006, 3000); Lima (C. L. Shear 569, P. A. Rydberg 2314); Mystic Lake (P. A. Rydberg 2247); Boulder Creek (F. Lamson-Scribner 4); Castle (P. A. Rydberg 3252, 3259); Spanish Creek Basin (P. A. Rydberg 3199, T. A. Williams 2007, 2039); Dry Fork Belt Creek (P. A. Rydberg 3355); Deer Lodge (P. A. Rydberg 2119, C. L. Shear 378); Manhattan (C. L. Shear 415); Columbia Falls (R. S. Williams 604). *Alberta*: St. Mary's River (J. Macoun 13038). *British Columbia*: Lower Frazer River, 49° north latitude (Dr. Lyall in 1859). *Idaho*: Nez Perces County (Sandberg, Heller, and McDougal 331); Hatwai Creek (L. F. Henderson 2828). *Washington*: (Sandberg & Leiberg 450); Pullman County (A. D. E. Elmer 253); Yakima (A. B. Leckenby 1898); Blue Mountains (C. V. Piper 2565); Columbia River, Klickitat County (W. N. Suksdorf 174); Waitsburg (R. M. Horner 568); Walla Walla (C. L. Shear 1593). *Oregon*: Elgin (C. L. Shear 1734); east side Harney Valley (J. B. Leiberg 2370); above Wallowa Lake (C. L. Shear 1803); Gearhart (C. L. Shear 1695, W. C. Cusick 650a). *Nevada*: Diamond Mountains (S. Watson 1327); Virginia Mountains (S. Watson 1326); Reno (S. M. Tracy 224). *California*: (J. G. Lemmon 1875); San Francisco (F. Lamson-Scribner in 1899); Mission Hills (Michener and Bioletti 123).

The original description of the above species, which is quoted in full below, applies so well to the specimens referred to, that taken in connection with some other circumstances, we feel little hesitation in taking it up. So far as we know, it has not before been recognized, except by Fournier (Mex. Pl. 2: 127), who seems to have somewhat misinterpreted it.

The plant has been generally referred to *Bromus breviaristatus* (Hook.) Buckl. l. c. It is the same as the specimen of *Bromus pauciflorus* Nutt. in Herb. Acad. Nat. Sci. Phil., upon which *B. breviaristatus* Buckl. was founded. Hooker appears to have included it in his *Ceratochloa breviaristata*, as there is a spikelet of it in the Gray Herbarium, which Dr. Gray has marked "original spec." The distribution of this plant by Hooker under the name *breviaristata* led Torrey, Gray, and Thurber to a misinterpretation of the species, for as already mentioned under *B. unioides*, Hooker's drawing and type clearly belong to that species.

We have been unable as yet to locate Nees's type specimen; but the fact that Hooker distributed this plant from Douglas's collection, taken in connection with the fact as shown in a season's work in the region of the Columbia that this species and its varieties are the most common bromes met with, there is left little doubt that we have the plant Nees described.

This species is quite variable. Toward the north it passes into *B. aleutensis* Trin., and southward into *B. polyanthus*, while near the Pacific coast it passes through var. *laticor* into *B. carinatus*.

Index Kewensis gives this as a synonym of *B. ciliatus* L., but this is evidently a mistake. The following is the original description taken from Steudel 1. c.:

"*Bromus marginatus* Nees (mpt. sub.: *Ceratochloa*).

"Folii vaginisque hirsutis; paniculæ erectæ strictæ radiis subsimplicibus; spiculis oblongo-lanceolatis compressis utrinque convexis pubescenti-scabris 6-8-floris; seta valvula sua 7-nervia duplo brevior. 2/ Douglas legit ad fluv. Columbia St. Louis."

31α. *BROMUS MARGINATUS LATIOR* n. var.

A larger and stouter plant than the species, sometimes reaching 17 or 18 dm. high. Panicle larger, 2-3 dm. long, with longest lower branches 10-20 cm. long, awn usually slightly longer, sometimes reaching 6 or 7 mm. Otherwise like the species.

Type No. 1615, collected by C. L. Shear, Walla Walla, Washington.

General distribution about the same as for the species, but in lower altitudes, being most common in the foothills and valleys down to about 1,600 meters.

SPECIMENS EXAMINED.—*New Mexico*: Santa Fe (Dr. George Vasey). *Utah*: Springdale (M. E. Jones 5242). *Colorado*: Ft. Collins (L. H. Pammel). *Arizona*: Little Laramie River (T. A. Williams 2233). *Wyoming*: Bozeman (C. L. Shear 476; P. A. Rydberg 2213); no locality (J. W. Blankinship); Sheep Creek (P. A. Rydberg 3308; F. L. Scribner 16); Spanish Creek (P. A. Rydberg 3337); East Gallatin Swamp (P. A. Rydberg 3171); Spear Basin (P. A. Rydberg 3155). *Idaho*: head of Little Potlatch River (Sandberg, Heller, & McDougal 434, 331); Lewiston (A. A. & E. G. Heller 3202); Moscow (L. F. Henderson 2829); St. Josephs River (J. B. Leiberger 1298). *Washington*: Walla Walla (C. L. Shear 1615); Pullman (C. V. Piper 1738). *Oregon*: (W. C. Cusick 650); Prineville (J. B. Leiberger 314). *California*: (J. G. Lemmon).

This plant has been collected by wool waste heaps at North Berwick, Maine. It is also escaped from cultivation about Ames, Iowa, from which place it is represented in the herbarium by C. R. Ball's Nos. 33 and 148.

Forms of this plant in Oregon and Washington connect with *B. carinatus hookerianus*, which is generally distinguished by its smoother spikelets and longer awns.

31β. *BROMUS MARGINATUS SEMINUDUS* n. var.

This differs from the species in the following particulars: Usually more leafy, but less pubescent or, in some cases, nearly smooth throughout; spikelets with empty glumes glabrous or slightly scabrous on the nerves; flowering glumes somewhat scabrous or scabrous-puberulent.

Type No. 1811 C. L. Shear, collected on open mountain side 5 miles above Wallowa Lake, Oregon.

Distribution about the same as for the species.

SPECIMENS EXAMINED.—*Utah*: Santa Clara (M. E. Jones 5118b); Ogden (T. A. Williams 2477; S. M. Tracy 322). *Wyoming*: Sherman (L. H. Pammel); Bear Lodge (T. A. Williams 2648, 2633); Sundance (D. Griffiths 984); Spread Creek (F. Tweedy 64). *Idaho*: Beaver Canyon (C. L. Shear 573); Forks of Boise River (L. F. Henderson 3271). *Yellowstone National Park*: (J. N. Rose 222). *Montana*: Spanish Creek (P. A. Rydberg 3028, 3104); Gallatin County (F. Tweedy); Bridger Pass (P. A. Rydberg 3219); Bozeman (P. A. Rydberg 2233½). *Assiniboia*: Cypress Hills (J. Macoun 13040). *Washington*: (G. R. Vasey; Kirk Whited 2, 4); Montesano (A. A. & E. G. Heller 3979). *Oregon*: Mountains above Wallowa Lake (C. L. Shear 1811, 1789, 1777, 1785, 1803, 1810, 1794, 1815, 1766, 1775, 1796); Wallowa Lake (C. L. Shear 1751, 1762); Hood River (L. F. Henderson); Hoover Creek (J. B. Leiberger 138); Government Meadows, Blue Mountains (C. L. Shear 1668, 1666); Blue Mountains (C. L. Shear 1679, 1688, 1674); Cathedral

Rocks, Crater Lake (Coville & Leiberg 379); Ravena (A. B. Leckenby); Portland (B. Killin); Grants Pass (T. Howell 251); hills northwest of Corvallis (M. Craig). *California*: (J. G. Lemmon 438; C. A. Purpus 5421); Donner Lake (L. H. Pammel); San Jacinto Mountains (H. M. Hall 785); mountains south of Dixie Valley (J. B. Davy); no locality (Vasey).

This form is the connecting link between *B. marginatus* and *B. polyanthus*. It, like the species, is a mountain plant extending up to about 3000 meters altitude or somewhat higher. In the lower altitudes the panicle tends to become longer and laxer, passing into variety *laxior*.



FIG. 34.—*Bromus polyanthus*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

32. *BROMUS POLYANTHUS*

Scribn. nom. nov. *Bromus multiflorus* Scribn. U. S. Dept. Agr. Div. Agrost. Bul. 13: 46. 1898. Not Weig. 1772, et al. (Fig. 34.)

A rather stout, erect, short-lived perennial. Culm smooth or puberulent at the nodes, mostly 6–10 dm. high. Sheaths typically smooth, rarely sparsely pilose; ligule about 2 mm. long, rounded, subentire; blades linear-lanceolate, mostly scabrous, especially above. Panicle elongate, erect, branches usually short and erect or slightly spreading. Spikelets mostly 3–3.5 cm. long, laterally compressed, carinate, rather densely 7–11 flowered; empty glumes broad, smooth or somewhat scabrous, the lower 3-nerved, rather obtuse or subacute, 6–8 mm. long, the upper 5–7 nerved, most obtuse, 9–11 mm. long; flowering glume 7 nerved, 13–15 mm. long, smooth or scabrous, rather obtuse, emarginate with a broad, hyaline margin; awn 4–6 mm. long; palea a little shorter than its glume.

Type No. 4024, collected by Aven Nelson at Battle Lake, Sierra Madre Mountains, Wyoming.

General distribution: Colorado and Utah north to Montana and Oregon.

SPECIMENS EXAMINED.—*Colorado*: Glenwood Springs (Shear & Bessey 1300); Buffalo Pass (Shear & Bessey 1434, 1474, 1484); Yampa (Shear & Bessey 1421); Red Dirt Divide, Routt County (Shear & Bessey 1347, 1362, 1385); near Pallas (Shear & Bessey 1411); Middle Park (G. Vasey); Robinson (C. L. Shear 1045); Rabbit Ears Pass (C. F. Baker 4). *Utah*: Logan (P. A. Rydberg 2347); Alta (M. E. Jones 1111); Fairview (M. E. Jones 5554m). *Idaho*: Beaver Canyon (C. L. Shear 596;

P. A. Rydberg 2342); Montpelier (T. A. Williams 2553). *Wyoming*: Bear Tooth Mountains (W. H. Forwood); Bear Lodge Mountains (T. A. Williams 2619); Jacksons Lake (W. H. Forwood); Elk Mountain (A. Nelson 4098); Buffalo Fork (F. Tweedy 65); Rife's Ranch (A. Nelson 3759, 3827); Seminole Mountains (A. Nelson 4921); Sierra Madre Mountains (A. Nelson 4035). *Montana*: Lima (C. L. Shear 5604). *Oregon*: Powder River Mountains (C. V. Piper 2529).

The above species is very closely related to *B. marginatus*, into which it passes and of which it should perhaps be regarded as a variety. It differs chiefly from the typical form of *B. marginatus* in being smoother throughout.

**32α. BROMUS POLY-
ANTHUS PANICU-
LATUS** n. var. (Fig.
35.)

A rather tall, leafy plant with a larger, laxer, more spreading panicle than the species and having the upper part somewhat nodding. The leaves are rather broader and the spikelets slightly narrower, with the florets rather looser in flower and the awn sometimes reaching 7 mm. long.

Type No. 333 Tracy, Earle, and Baker, collected in West Mancos Canyon, Colorado, altitude about 3,000 meters.

SPECIMENS EXAMINED.—*Colorado*: West Mancos Canyon (Baker, Earle and Tracy 333); Trimble Springs (Baker, Earle & Tracy 4301); Parrott (Baker, Earle & Tracy 4297); Buffalo Pass (Shear & Bessey 1493); Sheep Horn Divide (Shear & Bessey 1552); La Veta (C. L. Shear 812). *Utah*: Gunnison (L. F. Ward 286). *Arizona*: Strawberry Creek (D. T. McDougal 707).

This plant bears the same relation to the species that *B. marginatus latior* does to its species. Its distribution is more southern in general and most frequent in lower altitudes.

33. BROMUS ALEUTENSIS Trin. Griseb. in Ledeb. Flor. Ross. 4 : 361. 1853. (Fig. 35.)

A rather tall, stout perennial, with a lax, suberect panicle and broad, linear-lanceolate leaves. Culms 5–10 dm. high, erect, stout, usually slightly pubescent just below



FIG. 35.—*Bromus aleutensis*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

the nodes; internodes generally 3 to 4. Sheaths usually equaling or exceeding the internodes, coarsely striate, usually sparsely retrorsely pilose; ligule 4-5 mm. long, subrotund above, somewhat laciniate; blades mostly 20-35 cm. long, usually sparsely pilose on both sides. Panicle, 12-20 cm. long; lower branches 1-2, bearing 1-3 spikelets somewhat nodding, becoming more or less rigid and erect when old. Spikelets oblong-lanceolate, compressed, 2.5-3.5 cm. long, 7-9 mm. broad, 3-6-flowered; empty glumes broad, subequal, the lower distinctly 3-nerved, subacute, upper distinctly 5 or obscurely 7 nerved, obtuse, 10-13 mm. long, usually scabrous, especially on the nerves; flowering glume broadly lanceolate distinctly

7-nerved, with a broad membranous margin, smooth to scabrous-pubescent, averaging about 15 mm. long, bidentate at the apex, awned; awn stout, scabrous, mostly 9-11 mm. long; palea nearly equaling its glume, acute, ciliate-pectinate on the keels. Pachilla thinly pubescent, about 3 mm. long.

General distribution: Atka and Unalaska.

Type in Herb. Ledebour from Unalaska, collected by Eschscholtz.

SPECIMENS EXAMINED.—*Unalaska* (W. H. Evans 550 in 1897; Dr. A. Kellogg 142 in 1867; S. Applegate, no number or date; M. W. Harrington in 1871-72). *Atka* (L. M. Turner 1194 in 1880).

This species is very closely related to *B. marginatus*. The original description says "spikes glabrous," but we have amended it to include forms having scabrous-pubescent flowering glumes. Such forms coming from St. Petersburg Herb. and



FIG. 36.—*Bromus sitchensis*: a, empty glumes with two florets showing the palea; b, dorsal view of a flowering glume.

evidently determined by Trinius are in the Gray Herb. We have seen no specimens with perfectly glabrous spikelets.

34. *BROMUS SITCHENSIS* Bong. Obs. Veg. Sitch. 173. 1831. (Fig. 36.)

A tall, stout, leafy perennial. Culm smooth, nearly erect, 12-18 dm. high. Sheaths shorter than the internodes, smooth; ligule large, rounded entire or somewhat torn, 3-5 mm. long; blades linear-lanceolate, 2-4 dm. long, 7-12 mm. broad, sparsely

short-pilose above, smooth beneath. Panicle large, lax, drooping, 2.5-3.5 dm. long; lower branches 2-4, long, weak, spreading, usually bearing 1-3 spikelets on long, slender pedicels. Spikelets 2.5-3 cm. long, 6-8 mm. wide, oblong-lanceolate, strongly laterally compressed, rather loosely flowered; empty glumes acute, smooth or scabrous on the nerves, the lower lanceolate, 3-nerved, 8-9 mm. long, the upper broader, 5-7 nerved, 10-12 mm. long; flowering glume broadly lanceolate, acute, about 12-14 mm. long, 7-nerved, smooth or scabrous, shortly bidentate at the apex, with a straight awn 6-9 mm. long; palea considerably shorter than its glume, short pectinate-ciliate on the keels.

Type from the Island of Sitka.

General distribution: Alaska south to Washington, apparently near the coast.

SPECIMENS EXAMINED.—*Alaska*: Unalaska (Dr. A. Kellogg 142); Hope Island (Dr. A. Kellogg 143); Yes Bay (Thos. Howell 1722A)—a form approaching *B. aleutensis* in its shorter awn and somewhat broader flowering glume. *Cascade Mountains*: 49 n. lat. (Dr. Lyall in 1859)—a form approaching *B. carinatus hookerianus*.

This species is related to *B. aleutensis* and *B. carinatus hookerianus*, but most closely to the latter, from which it differs in the typical form in its more robust form, laxer panicle with fewer spikelets and much longer, weaker, spreading branches.

35. *BROMUS CARINATUS*

Hook. & Arn. Bot. Beech. Voy. Suppl. 403. 1841. *Bromus hookerianus minor* Scribn. in Beal, Grass. N. A. 2: 614. 1896. *Bromus oregonus* Nutt. in Herb. Acad. Nat. Sci. Phil. (Fig. 37.)



FIG. 37.—*Bromus carinatus*: a, empty glumes with three florets; b, dorsal view of a flowering glume.

An annual or biennial with erect culm, linear leaves, and erect

or suberect panicle. Culm about 5-8 dm. high, slightly pubescent at the nodes. Sheaths mostly shorter than the nodes, *retrorsely soft pilose*; ligule 3-4 mm. long, sublacinate; blades flat, *mostly narrow*, about 1-2.5 dm. long, 3-6 mm. broad, *thinly pilose both sides*. Panicle pyramidal, somewhat lax, about 1.5-2.5 dm. long; lower branches about 3, spreading, or somewhat drooping. Spikelets lanceolate to suboblong-lanceolate, compressed, about 2.5-3 cm. long and 5 mm. broad, 5-9 flowered; empty glumes lanceolate, acute, *glabrous to slightly scabrous-pubescent*; the lower distinctly 3 or sometimes obscurely 5 nerved, 7-9 mm. long; the upper 5 or sometimes obscurely 7 nerved, 9-11 mm. long; flowering glume lanceolate, obscurely

7-nerved, puberulent or short-pubescent, about 13-16 mm. long, bifid at the apex and tapering into an awn 7-10 mm. long; palea nearly equaling its glume, ciliate-pectinate on the keels; rachilla slender, somewhat pubescent, about 3 mm. long.

General distribution: Nevada, California, Oregon, and Washington.

Type collected by Douglas near Monterey or San Francisco, California.

SPECIMENS EXAMINED.—*Nevada*: St. Thomas Canyon (M. E. Jones 5069x in 1894).

Washington: western Klickitat County (W. N. Suksdorf 173 in 1885); Walla Walla (C. L. Shear 1579 in 1889); Fair Haven (C. V. Piper 2607 in 1897); Tacoma (A. B. Leckenby in 1898). *Oregon*: Eight Dollar Mountain (T. Howell in 1884, distributed as *Bromus hookerianus minor* Scribn.; 252 in 1887, large form with broad spikelets and glumes approaching *B. marginatus*); McMinnville (C. L. Shear 1617 in 1899). *California*: Santa Cruz (C. L. Anderson 128 in 1889); no locality (C. L. Anderson 120 in 1888; 76 in 1888; 96 in 1888—this specimen is about identical with specimens in the Gray herbarium from Douglas's collection which are evidently typical; 109 in 1888); Bear Valley, San Bernardino Mountains (S. B. Parish 3298 in 1894); San Bernardino Valley (S. B. and W. F. Parish 1534 in 1882); San Geronio (S. B. and W. F. Parish 1533—this is a rather broad-leaved, very robust form); San Diego (C. R. Orcutt 1178 in 1884; 511 in 1884); San Jose (Mrs. Bush in 1880); San Luis Obispo (Mrs. Summers); Mendocino County (J. W. Blankinship 35 in 1893); near Mendocino (H. E. Brown 747 in 1898); San Diego County (G. R. Vasey in 1880); Mariposa County (J. W. Congdon in 1895); Sonoma (E. Samuels 222); (J. M. Bigelow, Whipple expedition collection in 1853-54); Mount Hamilton (C. Rutter 92 in 1895); near Mount Shasta (E. Palmer 2626 in 1892—this is the form which Nuttall called *Bromus oregonus*; it differs from typical *B. carinatus* in its somewhat broader glumes and slightly denser pubescence); southeastern California (E. Palmer 546 in 1896); New York Falls (Geo. Hansen 627); Berkeley (J. Burt Davy 204 in 1893); Kellogg and Harford 1113 in 1868 and 1869); Los Angeles (S. M. Tracy 168 in 1887); Laguna (L. Schoenfeldt 3624 in 1894).

35α. BROMUS CARINATUS CALIFORNICUS (Nutt.) n. comb. *Bromus californicus* Nutt. in Herb. Acad. Nat. Sci. Phil.

A form intermediate between typical *B. carinatus* and *B. carinatus hookerianus*. Differing from the former in its nearly smooth leaves and sheaths and its flowering glumes merely scabrous. From the latter it differs in its narrower spikelets and glumes.

Nuttall's specimen in the Philadelphia Academy herbarium labeled "u. Calif." is a mere scrap showing only two small panicles from different plants and having a few small upper leaves. This form must be near *B. hookeri schaffneri* Fourn, judging from his description.

The following specimens from southern and Lower California have been referred to this variety. *Lower California*: Todos Santos Bay (Miss F. E. Fish 12); Potrero Valley (C. R. Orcutt, in 1889). *California*: San Diego (D. Cleveland 13); (C. R. Orcutt 511a).

35β. BROMUS CARINATUS HOOKERIANUS (Thurb.) n. comb. *Bromus hookerianus* Thurb. in Wilkes U. S. Exp. Exped. 17²: 493. 1874. *Ceratochloa grandiflora* Hook. Fl. Bor. Am. 2: 253. 1840. *Bromus virens* Buckl. Proc. Acad. Nat. Sci. Phil. 98. 1862. Not *B. unioides virens* Nees, Agrost. Braz. 470. 1829. *Bromus nitens* Nutt. in Herb. Acad. Nat. Sci. Phil. (Fig. 38.)

A robust plant, larger in all its parts than the species. Panicles erect, 2-4 dm. long; branches spreading. Spikelets 5-10 flowered, 3-4 cm. long, 5-7 mm. broad; empty glumes slightly broader and less acute than in the species; flowering glumes also broader and scabrous with a broad hyaline margin and an awn 10-15 mm. long.

General distribution: California to Washington and Idaho. Type in the herbarium of the Royal Gardens, Kew, England, collected on the "plains of the Columbia."

SPECIMENS EXAMINED.—*California*: San Jose (ex herb. State Normal School); Ojai Valley (F. W. Hubby 36). *Oregon*: Gearhart (C. L. Shear 1734½, a form approaching *B. marginatus*); near Rhea Creek (J. B. Leiberg 65); (W. C. Cusick 1321). *Washington*: Klickitat County (W. N. Suksdorf 16); Seattle (C. V. Piper and E. C. Smith 944); (C. V. Piper 818). *Idaho*: Valley of Clearwater River (Sandberg, Heller & McDougal 166).

This variety passes by various intermediate forms into the species and also into *B. marginatus*. It is so inconstant in character that it does not seem advisable to try to hold it to specific rank. Through the kindness of Sir W. T. Thiselton-Dyer, director of Kew Gardens, we have been permitted to examine a spikelet from the original specimen collected by Douglas on "Upland dry soils on the Multoonah (Oregon) 1826." This leaves no doubt as to the form which Hooker took as the type of his *Ceratochloa grandiflora*.

35γ. *BROMUS CARINATUS* DENSUS n. var.

A tall, stout, erect plant, with a dense panicle 3 dm. long. It differs from the species in its stouter habit, smoother leaves and sheaths, the leaves being smooth or merely scabrous, and the panicle with numerous rays, some of the lower being compound and bearing many spikelets. The spikelets are narrow, 2-2.5 cm. long, with the florets subdistant, showing the slender scabrous rachilla when in flower; empty glumes as in the species; flowering glume coarsely scabrous, about 1 cm. long; awn slender, 5-7 mm. long.

Type collected by Blanche Trask "about opuntia" on San Nicholas Island, California, No. 12, April, 1897. The specimen cited shows only the panicle and the upper leaf. We should be inclined to give this specific rank but for the fact that accompanying specimens from the same island show forms connecting it with the species.

35δ. *BROMUS CARINATUS LINEARIS* n. var. (Fig. 39.)

A somewhat caespitose plant, with slender, nearly erect culms and very narrow linear leaves. It differs from the typical form of the species in its narrow, subracemose panicle, 5-10 cm. long, and in its shorter and narrower leaves. The spikelets



FIG. 38.—*Bromus carinatus hookerianus*: a, an entire spikelet; b, flowering glume without the awn; c, caryopsis showing plumose apex; d, sterile flower showing the lodicules.

are slightly broader, glumes not so acute, and awn somewhat stouter and shorter, 5-7 mm. long.

Type in the herbarium of the Department of Agriculture collected by Dr. G. R. Vasey in California in 1875.

35e. *BROMUS CARINATUS ARIZONICUS* n. var.

Sheaths and leaves more scantily pilose than in the species. Panicle erect, narrow pyramidal to subracemose, spikelets and glumes slightly broader than in the species, empty glumes glabrous; *flowering glumes sparsely scabrous-puberulent*, less acute; *awn shorter, 5-6 mm. long.*



Fig. 39.—*Bromus carinatus linearis*: a, empty glumes with two florets; b, dorsal view of a flowering glume.

the nodes. Sheaths *smooth*; ligule about 2 mm. long, subtruncate, lacinate; blades *smooth*, both sides linear-lanceolate, ascending, somewhat stiff, 5-20 cm. long by 3-5 mm. broad. Panicle suberect or somewhat drooping, lax, about 10-17 cm. long, lower rays 3-4, slender, bearing 1-2 spikelets. Spikelets about 5-flowered, 2-2.5 cm. long, about 5 mm. broad, lower somewhat drooping, laterally compressed; empty glumes *smooth*, lower broad-lanceolate, acute, 3-nerved, 6-7 mm. long, upper broader, obtuse, 5-7-nerved, 8-9 mm. long; flowering glume ovate-lanceolate, *chartaceous, scabrous, 5-7-nerved, 11-13 mm. long*, with two short subacute teeth at the apex, and an awn 5-6 mm. long; palea about equaling its glume.

Type in the Herbarium U. S. Department of Agriculture, collected by C. G. Pringle in Santa Cruz Valley, Tucson, Arizona, May 3, 1884.

SPECIMENS EXAMINED.—*Arizona*: fifteen miles above PIERCES FERRY (M. E. Jones 5077ar); Tucson (J. W. Toumey 748, 798); Bradshaw Mts. (J. W. Toumey 27); near Congress (C. R. Orcutt 2531). *Texas*: El Paso (M. E. Jones 19a).

This may be the *Bromus hookeri schlechtendalii* Fourn. Mex. Pl. 2: 127. 1886, as it differs only in a few minor particulars from the original description of that variety. It also closely approaches *B. marginatus seminudus*.

36. *BROMUS LACINIATUS* Beal, Grass. N. A. 2: 615. 1896. (Fig. 40.)

An erect perennial with a lax, somewhat secund panicle and laterally compressed purplish spikelets. Culm about 5-7 dm. high, smooth or slightly pubescent at

Type No. 4897 C. G. Pringle, Pl. Mex. 1894, Sierra de San Felipe, alt. 9500 ft., State of Oaxaca.

The above description is from the specimen of the above number in the National Herbarium. The species has not been reported from the United States, but it may extend this side the Mexican border. It resembles very closely small forms of *B. polyanthus paniculatus*.

SPECIES EXCLUDED.

Bromus giganteus L. Sp. Pl. 1: 77. 1753. = **Festuca gigantea** Willd.

Bromus secundus J. S. Presl

in C. B. Presl, Reliq.

Haenk. 1: 263. 1830.

"Hab in sinu Nootka" =

Festuca rubra secunda

(Presl.) Scribn. Rept. Mo.

Bot. Gard. 10: 39. 1899.

Bromus subulatus Griseb. in

Ledeb. Fl. Ros. 4: 358.

1853. = **Melica subulata**

Scribn. Proc. Acad. Nat.

Sci. Phil. 1885: 47. 1885.

SPECIES DOUBTFUL OR UNKNOWN.

Bromus depauperatus, J. S.

Presl in C. B. Presl, Reliq.

Haenk. 1: 263. 1830. "Ra-

dice repente, culmo glabro,

foliis planis vaginisque

scabris, panicula secunda

nutante simplici laxa paten-

tissima, locustis subtrifloris,

paleis inferioribus tereti-

usculis trinerviis scabris.

Hab. in sinu Nootka. ♀."

"Similis *Bromus aspero*, Ra-

dix repens, firma, crassa,

fusca, multas fibras emit-

tens. Culmus sedecim pol-

lices altus inferne crassitie

pennæ anatinæ, erectus

teres, striatus glaber. Nodi

fusci, scabri. Vaginæ elon-

gatæ, arcte adpresse,

striatæ, versus collum scabriusculæ. Ligula: margo angustissimus, fimbriolatus.

Folia vaginis longiora duas et dimidiam lineam lata, linearia, plana, utrinque scabra. Panicula quinque pollices longa, laxa, secunda, nutans. Rhachis inferne teretiuscula glabra, superne angulata scabra. Rami alternatim binati, flexuosi, angulati, scabri, paucas locustas gerentes. Pedunculi locusta breviores, ramis conformes. Locustæ lanceolatæ, tri-bifloræ, virescenti flavæ. Glumæ locusta triplo breviores, ovato-lanceolatæ, setaceo-terminatæ, glabræ, inferior minor uninervia, superior fere duplo longior trinervia. Flosculi subulati, teretes, distantes. Rhachicula flexuosa, scabriuscula. Palea inferior ovato-lanceolata in apicem



Fig. 40.—*Bromus laciniatus*: a, empty glumes with two florets, b, dorsal view of a flowering glume.

acutissimum protracta, apice bidentata dentibus setiformibus, extus scabriuscula, trinervia. Arista paulo brevior, scabra, recta, palea superior paululum brevior, acutissima apice bimucronata, binervia, bicarinata, carinis scabra, pagina exteriore scabriuscula."

Judging from the description of the spikelets and the florets, this is not a true *Bromus*, although Dr. Beal in his Grasses of North America regards it as such, and has referred to it collections by Bolander and Kellogg from San Diego, California.

Bromus segetum H. B. K. Nov. Gen. et Sp. Pl. I. 151. 1815. "B. culmo glabro; foliis vaginisque pilosis; panicula subsimplici, verticillata, secunda, nutantē, ramis rhachique hispidō-scabris; spiculis lineari-oblongis, subsexfloris; glumis paleisque glabriusculis; arista longitudine paleæ. Crescit in cultis regni Quitensis, prope Lloa, Villa de Ibarra et Chillo, alt. 1340-1500 hexap. ☉ Floret Januario. Culmi erecti, tri-aut quadripedales, simplices, teretes, striati, glabri. Nodi pilosi. Folia linearia, acuminata, plana, striata, externe piloso-scabra, interne pilosa. Vaginæ striatæ pilosæ. Ligula ovata, obtusa, glabra. Panicula subsimplex, secunda, verticillata, nutans, pedalis, ramis longissimis, nigro-purpurascens, hispidō-scabris, spiculas duas aut tres, rarius unicam ferentibus. Rhachis piloso-scabra. Spiculæ lineari-oblongæ, quinque-aut sexfloræ. Glumæ inæquales, inferior duplo brevior, lanceolato-subulata, apice scabriuscula, superior oblonga, acuminata, subaristata, trinervia, virescens, glabriuscula, spicula triplo brevior. Paleæ lanceolato-oblongæ, glabriusculæ, subæquales, inferior acuminata, subquinquenervia, superior bicarinata, angustior et tenuior, apice bidentata, in carinis ciliato-scabra. Arista subterminalis, recta, scabra, longitudine paleæ. *Bromo arvensi* simillimus."

Bromus setaceus Buckl. Proc. Acad. Nat. Sci. Phil. 14: 98. 1862. "Culmo erecto 2-3 pedali; vaginis inferioribus glabris, superioribus marginibus et faucibus parce villosis; ligulis 2-3 lin. lon. apice laciniatis; foliis glanis pubescentibus margine ciliatis 4-6 pollicaribus 3-4 lin. latis; panicula diffusa composita 6-8 pollicari 4-5 pollic. latis; radiis 5-7 nis basi nudis hirsutis ad apicem compositis; ramulis 3-4 nis, unispicatis; spiculis 4-5 floris oblongo obovatis; glumis parum inæqualibus carinatis lineari lanceolatis ciliatis acuminatis, marginibus apicibusque albo-hyalinis, superiore 3-5 nervia; valvula inferiore lanceolata 5-7 nervia ciliata apice bifida et aristata; seta 6 lin. lon. Northern Texas."

"The longest of the lower branches of the panicle 3-4 inches in length and the shorter branches 1-2 inches long, all destitute of spikes excepting near their tops; spikes loosely flowered; internodes on the rachis 1-2 inches long; pedicels 4-6 lines in length; spikes without the bristle about ½ inch long, loosely flowered; upper florets abortive, 2-3 united, appearing to the naked eye like one with 2-3 bristles."

Dr. Gray says in his notes on Buckley's paper published in the volume cited that this is *B. sterilis* L., but the description does not apply closely enough to that species to warrant us in accepting it as a synonym of that. Nuttall's and Buckley's specimens, kindly loaned us by the Philadelphia Academy, did not contain this plant, so it must remain doubtful for the present.

